X

# SUGGESTIONS

REGARDING

# FOREST ADMINISTRATION

IN

# BRITISH BURMA.

BY

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WITH ONE MAP.

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# SUGGESTIONS

REGARDING

# FOREST ADMINISTRATION IN BRITISH BURMA.

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## INTRODUCTION.

I LANDED at Rangoon on the 31st December 1879, and started on the 8th January 1880 on my tour, in company with Mr. B. Ribbentrop, the Conservator of Forests, Pegu Circle. The Kyetpyoogan and Magayee plantations were inspected on the 8th, 9th, and 10th January, and the 15th to the 21st January were spent in the Thoonzai, Beeling, and Mokka forests. After a week's stay at Prome we went by train to Zeegoong, and examined the Kangyee, Boben, Minboo, Shaboung, and Toungnyo forests from the 30th January to the 7th February. On the 8th the Pegu Yoma was crossed, and we marched through the Hpyoo and Khaboung forests to Toungoo, which we reached on the 16th. From Toungoo we visited the Pyoon Choung plantation, and on the 23rd February I left Toungoo and proceeded across the hills to the Salween District, where Major Seaton, the Conservator of the Tenasserim Circle, met me near Hothuta on the 6th March. In company with Major Seaton I visited the Upper Salween and Yoonzaleen forests, and we reached Moulmein on the 22nd March. At Rangoon I spent the time from the 9th April to the 1st May, on which day I left for Calcutta. The present report only relates to forest matters in Pegu and Tenasserim. In Arakan no regular forest administration has yet been introduced.

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## PART FIRST.—General.

### CHAPTER I.

#### OBJECT OF FOREST CONSERVANCY IN BURMA.

2. The chief object of forest conservancy in Burma is to ensure the permanent production annually of a sufficient quantity of teak and other valuable kinds of timber and other forest produce, to provide for the requirements of Burma and other countries.

Teak may justly be called the prince of woods; it combines in a remarkable manner many useful qualities, and hence its employment for a variety of purposes in Europe, India, and other countries is steadily extending. Teak has held its own against the large number of magnificent woods which are exported from North and South America, and which have been discovered in Australia and South Africa.

#### Teak timber—its value.

3. Hence teak in the London market maintains a price which is higher than the price of any other timber, and which is surpassed only by mahogany and one or two other furniture and fancy woods. The following extract from

Messrs. Churchill and Sim's price current of wood in the London market, of 4th March and 3rd April 1880, will serve to illustrate these remarks:

| | £ s. | £ s. | |
|---|---|---|---|
| Baltic Oak timber, Memel, Crown ... | 4 10 to | 5 0 | per load of 50 cubic feet. |
| American timber, Oak, Quebec ... | 5 0 „ | 6 0 | do. do. |
| Do. do., Elm, Rock ... | 4 10 „ | 5 10 | do. do. |
| Do. do., Ash ... ... | 3 5 „ | 4 10 | do. do. |
| Indian Teak .. ... | 14 0 „ | 16 0 | do. do. |
| British Guiana, Greenheart ... | 7 10 „ | 8 0 | do. do. |
| Australian Iron Bark ... ... | 6 0 „ | 7 10 | do. do. |
| Rosewood, Rio ... | 14 0 „ | 25 0 | per ton. |

Owing to unusually small stocks in the London Docks, the price of teak was exceptionally high this spring, but it rarely falls below £10 per load.

**Limited area of supply.**

4. The high price of teak is, however, due not only to the intrinsic and real value of the wood, but also to the limited area of supply. There are fine teak forests in Southern and Central India, but the timber produced in these forests is wanted to meet the requirements of the country, and is not sufficient to meet these requirements. Hence considerable and annually increasing quantities of teak are imported from Burma at Calcutta, Madras, Bombay, and other Indian ports. Java imports teak from Burma, though the tree grows, indigenous and planted, in the north-eastern corner of the island. Teak is also found in the forests of Borneo, but the timber is not exported.

5. The Trans-Gangetic or Eastern Peninsula of India contains the only teak forests of sufficient extent to furnish the material for a large export trade, and these forests are situated in Burma, in the northern provinces of Siam, and in the Karennee country.

The great bulk of the teak produced in this peninsula is found in the forests on the hills drained by the tributaries of the Salween, Sitang, and Irawaddy rivers, and must consequently be exported from Rangoon or Moulmein. There are fine teak forests at the head of the Meklong River, east and south of the British forests on the Upper Thoungyeen, and there are extensive teak forests near the sources of the Menam River in the Chieng-may (Zimmé) territory. Bangkok is the outlet for these forests, but the export of teak from that place has not hitherto been considerable; and though it may increase, Bangkok is not likely to enter into serious competition with the Burma ports. For, apart from the difficulties of the harbour, the teak localities are high up the streams, and it takes a long time to bring out the timber.

There is teak on some of the feeders of the Kambodia River, but it may be regarded as certain that the export of teak timber from Saigon will never be very important.

6. Thus the Burma ports have been, and will probably continue to be, the chief sources of teak timber. The increased consumption of this article is illustrated by the figures of a statement, exhibiting imports and exports of teak timber into and from Rangoon and Moulmein during the last 23 years, which is appended to this report. This period of 23 years has been divided into four; one of eight and three of five years each. During each of these four periods the mean annual imports from all sources, the mean annual exports beyond sea, and the difference which indicates the quantity consumed locally in British Burma, have been as follows:

| Periods. | Mean Annual Imports | Exports | Local consumption |
|---|---|---|---|
| | in tons of 50 cubic feet. | | |
| 8 years, 1856-57 to 1863-64 ... | 85,056 | 76,763 | 8,293 |
| 5 do., 1864-65 to 1868-69 ... | 112,884 | 108,020 | 4,864 |
| 5 do., 1869-70 to 1873-74 ... | 133,204 | 98,095 | 35,109 |
| 5 do., 1874-75 to 1878-79 ... | 227,149 | 134,563 | 92,586 |

**Increased consumption of teak timber.**

7. The quantities imported approximately represent the total quantities consumed in Burma, India, Europe, and other countries during the same periods. Hence the total mean annual consumption of teak timber has

gradually increased from 85,000 tons to 227,149 tons. The exports have also increased, but not in the same ratio. They were 76,763 tons a year from 1856-57 to 1863-64, and rose to 134,563 tons during the period from 1874-75 to 1878-79. Of the exports a large proportion goes to Indian ports, the mean of the last five years being as follows:

| | Tons of 50 cubic feet. |
|---|---|
| Exports to Indian ports ... ... ... ... | 85,635 |
| Exports beyond India ... ... ... ... | 48,928 |
| Total Exports ... | 134,563 |

The largest increase has taken place in the quantity locally consumed, which has risen from 8,293 tons during the first period, when extensive public buildings were built at Rangoon, and 4,864 tons during the second, to 92,586 tons during the last period.

8. It is significant that this increased consumption has in no way been aided by diminished prices. Broadly speaking, it may be said that, subject to the usual fluctuations, teak timber at Rangoon and Moulmein commands about the same price now which it fetched 20 years ago. There is every reason to anticipate that the annual consumption will continue to increase, and should it hereafter become possible to sell teak timber at the Burma ports at lower rates, or should freights diminish, a very large increase in the annual consumption may be anticipated.

**Prospects of future supply.**

9. During the last five years the mean annual imports into Rangoon and Moulmein have been as follows:

| | Tons of 50 cubic feet. |
|---|---|
| From forests beyond the frontier ... ... ... | 183,414 |
| From forests in British territory ... ... ... | 43,735 |
| Total ... | 227,149 |

The question now arises: Will the forests beyond the frontier continue to yield the large outturn which at present is obtained from them, and how far are the British forests capable of supplementing any diminution in the yield of the foreign forests?

**From foreign territory.**

10. Regarding the present condition of the forests beyond the frontier no reliable information whatever is available.

The following figures show that the increased outturn during late years is to some extent due to the great stimulus given to the working of the forests north of the Pegu frontier, particularly on the Sitang River.

Total quantities of teak timber imported from foreign territory during the last 15 years (in tons of 50 cubic feet):

| | Rangoon. (Irawaddy and Sitang.) | Moulmein. (Salween.) | Total. |
|---|---|---|---|
| 5 years, 1864-65 to 1868-69 ... | 88,578 | 302,192 | 390,770 |
| 5 do., 1869-70 to 1873-74 ... | 86,203 | 351,431 | 437,634 |
| 5 do., 1874-75 to 1878-79 ... | 231,563 | 685,506 | 917,069 |

11. Upon the whole it may be said regarding the forests beyond the frontier, that while a proportion of the forests on the feeders of the Salween River have been nearly worked out, there are still large areas of teak forest entirely untouched on the tributaries of the Sitang and Irawaddy rivers. But so much is certain, that the areas stocked with teak beyond the frontier, in the hills drained by these three rivers, are extremely extensive, and there seems every reason to hope that the present rate of outturn will yet be maintained during a considerable period. On the other hand, it is equally certain that under the present system of working, combined with the unrestricted cutting

and burning of teak in clearings for temporary cultivation, called toungyas, the exhaustion of these forests is only a matter of time. Under the operation of the annual fires, and with the removal at one time of most seed-bearing trees, the regeneration of the teak is impossible, and the forest must gradually but surely deteriorate.

12. During the last 23 years the forests beyond the frontier have yielded two millions and a quarter tons of timber, which, under a not very careful system of working, has probably necessitated the felling of an equal number of trees. Over what area these fellings have extended it is quite impossible to say. But so much is certain, that these cuttings must have put an end to the regeneration of teak over large areas—probably not less than a thousand square miles in different parts of the country, and that they have effected the impoverishment of a much larger area. However, the teak localities beyond the Northern frontier cover many thousand square miles, and though the working of the remaining forests may be more expensive, by reason of the greater distance of the timber from waterways which admit of floating, there is doubtless yet a large area available for the export of timber.

**From British Burma.**

13. The British Burma forests have during the last 23 years, while under regular management, yielded 802,000 tons of timber, or at the rate of nearly 35,000 tons per annum on an average. The greater portion of this outturn has been obtained from forests worked under a regular system intended to secure their protection and improvement; the smaller portion has come from forests in the occupancy of private persons, and between 1861 and 1874 from Government forests which, under the orders of the Government of India, were thrown open to private enterprize. Nor has the protection of the Government forests worked under a regular system been complete, inasmuch as large areas of teak-producing forest have annually been destroyed by toungya clearings. Nevertheless, it must be said, speaking broadly, that those Government forests which have been worked under a regular system have not deteriorated, and that over extensive areas there has been great and marked improvement in their condition.

14. Regarding the future, it may be said that during the next 40 years it will probably be possible to maintain the mean annual yield of the British forests in teak timber at the same figure as during the last 23 years. After that period the outturn will increase largely, provided a sufficient area of teak-producing forest is now demarcated and placed under efficient protection. I have mentioned a period of 40 years, but our knowledge of the present state of the forests is not sufficient to enable us to form any definite conclusions on this subject.

There are indications which tend to show that large areas are richer in mature timber and in timber of the smaller classes than has hitherto been supposed. If these indications are verified by actual experience, then the increased yield may commence after a shorter period than 40 years.

Again, should the outturn of the foreign forests show signs of an earlier exhaustion than is expected at the present time, then cuttings in the Government forests must be anticipated in order to guard against a serious decrease in the supply.

**Conditions necessary to secure future supply.**

15. All this can be done if a sufficient area of teak-producing forest is demarcated at once, and if operations for the efficient protection and improvement of this area are set on foot, and are steadily continued on a sufficient scale. But the first condition of success is to obtain the requisite area, and it must be clearly understood that if this condition is not fulfilled, the anticipations of the present report regarding the yield of the forests cannot be realized.

**Estimate of 1856.**

16. When the first working-plan was framed to regulate the yield of the forests in Pegu and Tenasserim for the twelve years from 1856 to 1867, the area of teak-producing forest was estimated at 2,397 square miles. The

details of this estimate have often been considered, and there is no reason for materially modifying it. On the ground of a large number of valuation surveys made in the forests between 1856 and 1862, it was estimated that in 1856 this area contained 1,855,000 mature teak trees above 6 feet in girth. From the data available in 1856 it was calculated that teak trees in these forests would attain a girth of 6 feet on an average in 62 years, and upon this assumption the maximum number of trees to be girdled annually in the forests to which the working-plan related was fixed at 27,000.

**Estimate of 1868.**

17. When in 1868 a plan was framed to regulate the cuttings during the period of five years from 1869 to 1873, certain forests were excluded from the area for which the plan was framed, viz., the Western and Upper Salween forests, which were leased out with permission to girdle, and the Pandaw and Attaran forests, which were in the hands of private parties. These excluded forests aggregated 416 square miles, and on the remaining 1,981 square miles, for the working of which the plan was framed, it was estimated that the number of mature trees in 1868 was 934,000. From additional data collected in 1868 it was concluded that the rate of growth of teak was considerably slower than it was believed to be when the first estimate was framed. In 1868 it was assumed that teak trees attain a girth of 6 feet on an average in 160 years, and the number of trees to be girdled annually in the area to which the provisions of the working-plan applied was fixed at 11,600.

**Conclusion.**

18. No attempt will be made on the present occasion to determine the number of trees to be cut annually in the forests; this is impossible while the work of demarcating the reserved forests has not been completed, and while, consequently, the area which will remain at the disposal of Government is uncertain. Nor are sufficient data available to form conclusions regarding the growing stock of teak trees of different ages and the average rate of growth of the teak tree. But from the data which are available, it seems probable that while the earlier estimates were too favourable, those made in 1868 assumed the prospects to be too unfavourable, both as regards rate of growth and the growing stock of teak in the forests.

19. As regards the production of teak timber, the main question to be discussed in the present report must be—What steps have been taken, and what steps require to be taken, to ensure the demarcation of a sufficient area of teak-producing forest to be permanently maintained as such? And as the demarcation of reserved forests must necessarily take time, measures must also be devised to continue the present system, under which teak is protected throughout the country.

**Other trees.**

20. Besides the production of teak timber, however, forest administration in Burma has other objects to fulfil, which should briefly be noted before proceeding further. There are certain timbers other than teak which are used largely, and some of which are exported, and there are certain kinds of forest produce which are important articles of trade. Most of the trees which yield these products are still plentiful; but some are getting scarce, and all will in certain districts sooner or later require protection. A complete account of all useful timbers and forest products of Burma would fill a book; here it must suffice to name a few of the most important, which, as far as we can see at present, may require special measures of protection at no distant date. The Annual Forest Reports of Burma and the two excellent works by the late Sulpiz Kurz—the "Preliminary Report on the Forest and other Vegetation of Pegu," and the "Forest Flora of British Burma,"—contain nearly all the information on this subject that is available at the present time.

21. Eng *(Dipterocarpus tuberculatus)* is one of the most common trees in Burma. Eminently gregarious, it forms, with a few other kinds, the well-known Eng forests, which cover in long broad stretches many hundred square miles on the rising ground which intervenes between the rivers and the foot of the hills. The tree is so abundant that it was never thought possible that it

could be exhausted or become scarce. However, it is a favourite wood for building; and so large has been its consumption of late years, that certain tracts, notably some of the Eng forests between the Hline River and the hills, have become denuded of large trees. The tree is one of the twelve kinds which were declared reserved in 1876. It should, however, be clearly understood that the tree does not need protection throughout the Province, but only here and there, in forests within reach of large towns, where it is likely to be cut to excess. Engyin *(Pentacme siamensis)* and Theya *(Shorea obtusa)*, both commonly found in the Eng Forest, were included among the reserved trees of 1876. The wood of both is extremely durable, but so hard and heavy as to preclude its general use. The trees do not at present require any special protection.

22. The species of Kanyin *(Dipterocarpus laevis, turbinatus,* and *alatus)* are important as yielding wood oil, and because the huge stems of these trees furnish boat-hulls, which, though not very durable, are extensively used. The trees are also abundant in remote districts, where there is no demand for the oil; and in such places there can be no objection to the use of the wood for boat building. But in the vicinity of populous districts, where the oil is extracted and is a necessary of life, or an article of trade, some restriction upon cutting the trees for boat building must be imposed, and action in this respect has already been taken in the Shway-gyeen District, where the cutting of the tree was prohibited by the Deputy Commissioner as a temporary measure a few years ago. Kanyin is also one of the twelve kinds which were declared reserved in 1876. Though in a large portion of Burma kanyin is so abundant and so little used that it does not require special protection, district officers should have the power to regulate the tapping of wood oil and to restrict or prohibit the cutting of kanyin trees, wherever such may be necessary.

23. Of much greater value for boat building than kanyin are Thingan *(Hopea odorata)* and Koung-mhoo *(Parashorea stellata)*, the timber of these kinds being exceedingly durable. Large stems of thingan fetch a higher rate per cubic foot than teak, and the tree is cut recklessly wherever it can be brought to a market. The forests in the Sitang Valley, on the Yoonzaleen, on the Salween below the rapids, and those along the coast south of Moulmein, furnish large quantities annually of this valuable wood; and even from Mergui thingan boat-hulls are taken by steamer to Rangoon. The wood is heavy and logs of it do not float, but attempts are about to be made to float canoes of thingan from the Thoungyeen forests over the Salween rapids to Moulmein. In places easy of access and easy to work, no thingan trees fit for the market are left, all straight and sound trees down to 4½ feet in girth having been cut. And koung-mhoo has been cut almost to the same extent as thingan. Thingan is also much prized for making solid cart wheels, which fetch high prices and are said to last 70 to 80 years. Thingan, but not koung-mhoo, was included among reserved trees in 1876, and it is certainly desirable to have the power to protect these two valuable species against waste and reckless destruction.

24. Three species of *Sterculia*, known under the generic name of Shaw, *St. versicolor, villosa* and *ornata*, are important, not on account of their wood, which is worthless, but in so far as the bark is made into ropes. The trees of these kinds are found, but are not common, in the dry deciduous forest, often associated with teak. They are cut down wholesale for the sake of the inner bark or *liber*, and there are forest districts where they are scarce and where no supply of the bark is obtainable. Shaw is not included among reserved trees.

25. Two furniture woods, Thitka (*Pentace burmanica*) and Thitkadoe (*Cedrela* sp.), were declared reserved trees as long ago as June 1873. The demand for these woods, however, is not steady, and it cannot be said that it is increasing. Yet neither of these woods is plentiful, and thitka at least has already become scarce in some parts of the Sitang Valley, where it is found in the mixed forest at the foot of the hills. Under thitkadoe several species of *Cedrela* or allied genera are included; one of which, Toungdama, is commonly found in the Upper Salween forests. The Kahiloo forest, in the Yoonzaleen Valley, a reserve of 9,600 acres, has been selected and demarcated specially with reference to the thitka and thingan which it contains.

26. Thitsee (*Melanorrhœa usitata*), the black varnish tree of Burma, is not uncommon here and there in the Eng Forest. Where sufficiently plentiful and near villages, the tree is generally tapped for varnish, licenses being granted by Deputy Commissioners. With a wedge-shaped chisel two slanting slits, meeting at an acute angle, are made upwards through the bark, and a short bamboo tube is driven in below the point where the two slits meet. The varnish exudes from the inner bark near its contact with the wood, and runs into the bamboo tube. Some trees have 40 to 50 of these scars, and some scars are at a height of 30 feet. The tree yields no varnish while it is leafless in the hot season, and it is chiefly tapped between July and January. One man can attend to 1,200 scars and can collect 146 to 182 lbs. in one season, worth at Rangoon from Rs. 40 to Rs. 50.

The tree has a heavy close-grained wood, dark-red, which takes a beautiful polish and is used for a variety of purposes. There is no reason to apprehend that the tree is at present over-tapped, or that it is cut on too large a scale for the sake of the wood, but there should be the power, if necessary, to protect a tree which yields a produce so valuable and so extensively used. Thitsee is included among the trees which were reserved in 1876.

**Cutch.**

27. Of leguminous trees Cutch *(Acacia Catechu)* is the most noteworthy. The cutch tree is only found in the drier parts of the Province. It is common in the Irawaddy Valley, on both sides of the river, north of Henzada, and here it is found both on the low ground near the Hline or Meimakha River, as well as on dry hills of the Thayet, Prome, and Tharawaddy Districts. On the hills it is frequently associated with teak, and often springs up on deserted toungyas as the dominant tree. In the Sitang Valley it is only found north of Toungoo, and on the Tenasserim side it is limited to the Upper Salween forests, above the Solochoung.

28. The heart-wood lasts better than teak, and many thousand young trees are cut annually for house posts. But the chief product of the tree is the cutch or catechu. During the dry season, from December to March, large settlements of people from beyond the frontier, and from the Thayet or northern part of the Prome District, establish themselves in the midst of a tract where mature trees still exist, near water, and if possible on the banks of a river. All trees with a sufficient quantity of heart-wood within reach of the settlement are cut down, and the logs are dragged to the spot by bullocks and buffaloes. The heart-wood is cut into chips, which are boiled with water, the solution being afterwards boiled down and the extract, when dry, cut into flat cakes—shining dark-brown, nearly black,—the cutch or catechu of commerce. Until 1876 cutch boiling was carried on everywhere in British Burma without any tax, check, or restraint, except in the few reserved forests which then existed. Since then licenses have been issued by Deputy Commissioners of districts, a certain rate being paid for each cauldron employed on the work. At first the rate was low, Rs. 5 per cauldron being paid for the season. It is now Rs. 10 per cauldron in Tharawaddy, and will next year be raised to the same figure in Prome. One cauldron in full work requires the wood of about 20 average-sized trees a month, or of 80 trees during the season. Hence at the rate of Rs. 10 per cauldron, the revenue received by Government amounts to about 2 annas per tree.

29. In 1873 catechu at Rangoon sold at the rate of Rs. 20 for 100 viss (365 lbs.); in 1879 it sold at the rate of Rs. 36 for 100 viss, and there is no prospect of the price declining. The revenue realized by Government from cutch boiling during the last three years in Pegu has been as follows:

| | Rs. | | | |
|---|---|---|---|---|
| 1876-77 ... | ... | 15,956, estimated to represent | 300,000 | trees cut. |
| 1877-78 ... | ... | 20,125 | ditto | 300,000 | ditto. |
| 1878-79 ... | ... | 12,090 | ditto | 150,000 | ditto. |

So that on a low estimate about 750,000 trees have been cut during the last three years in the upper part of the Irawaddy Valley. The diminished revenue in 1878-79 is probably caused by diminished supply.

This certainly is destruction on a large scale, and its effect is seen everywhere. Trees fit to yield cutch have almost disappeared from all but remote valleys in the Tharawaddy, Prome, and Thayetmyo districts outside the reserved forests. The Toungnyo Valley in Tharawaddy was formerly one of the chief habitats of the tree. On our late journey we found all trees fit to yield cutch cut in the lower part of that valley, and large settlements of cutch boilers from Kama and Meaday busily cutting trees and boiling cutch high up near Thamadee. They will have a few seasons' more work in that part of the valley outside the reserve, but then their employment in this part of the district will cease. Fortunately, the reserved forests in these districts include tracts in which the tree is found, and here it has been protected ever since the forests were demarcated.

30. Cutch is a most important article of the world's trade, and, like teak, the Burma forests are the chief source of supply. In 1879-80 the export of this article from Burma and other Indian ports was as follows:

| | Tons of 20 cwts. | Value Rs. |
|---|---|---|
| Bengal* ... ... ... | 3,388 | 9,08,389 |
| Bombay .. ... ... | 2 | 756 |
| Madras . . .. | 2 | 703 |
| Burma . .. ... ... | 7,714 | 19,04,146 |
| TOTAL . | 11,106 | 28,13,994 |

And the total quantity exported from Indian ports during the last five years, together with its value, has been—

| YEARS. | Quantity (in tons of 20 cwts.) | VALUE | |
|---|---|---|---|
| | | Total. | Per ton. |
| | | Rs. | Rs. |
| 1875-76 ... . | 9,762 | 16,87,846 | 173 |
| 1876-77 .. . | 13,247 | 25,05,515 | 189 |
| 1877-78 ... .. .. | 9,766 | 18,27,563 | 187 |
| 1878-79 ... .. | 10,859 | 18,79,265 | 173 |
| 1879-80 | 11,106 | 28,13,994 | 253 |
| TOTAL . | 54,740 | 1,07,14,183 | 196 |

No substance has yet been artificially made, nor is it likely to be made, that will prove a substitute for cutch and other first class tanning materials. A portion of the Burma supply comes from beyond the frontier—nevertheless, the exhaustion of the supply from British territory should be prevented.

31. A remedy has been suggested with great confidence, viz., to prohibit the cutting of trees below a certain girth for cutch boiling. As a matter of fact, however, only large trees and such as have a sufficient quantity of heart-wood, are cut for that purpose, and if a restriction were introduced in this direction cutch trees of small size would nevertheless continue to be cut on a large scale in toungyas and for house-building.

To prohibit the cutting in toungyas and for house-building of a tree which in certain districts is almost ubiquitous, growing as it does on low as well as on high ground, is out of the question, and the only measure which will ensure the maintenance of a continuous supply of this article in British Burma is to include a sufficient area of cutch-producing forest within demarcated reserves. Fortunately, the tree re-produces readily in Burma, grows

* The greater part of the cutch shown as exported from Bengal is probably Burma cutch imported into Calcutta and re-exported from that place. During 1879-80, 4,391 tons of cutch, valued at Rs. 14,27,006, were imported into Bengal from Burma.

rapidly, and does not suffer much from fires. In cutch reserves the cutting of toungyas on a rotation of 20 years might be permitted, the mature cutch trees being sold before the toungya is made, provided cutch seed were sown with the paddy. A plan somewhat to this effect is, I understand, under consideration by the local forest officers in Pegu.

Mr. Baden-Powell, when on deputation in Burma in 1872 and 1873, strongly urged the demarcation of reserves for the production of cutch in Burma, and certain areas were selected and declared reserved forests. Unfortunately, due enquiry was not made at the time into the cultivation and villages existing within the limits of those areas; nor were efficient measures taken to demarcate them; and the result has been that two of these, Thabyelah (8,000 acres) and Bangong (1,920 acres), are now occupied by villages, fields, and toungyas instead of forest. They were forest reserves in name only, and no alternative remains but to abandon them.

32. Pyinkado *(Xylia dolabriformis)* is valuable on account of its exceedingly durable, hard, and heavy timber. The tree is abundant almost everywhere in the deciduous forest of Burma, and it is not rarely found in the evergreen forest. Although a slow growing tree, it is not likely to be exhausted by any demand that can reasonably be expected to arise. If it could be floated it would probably be the wood most used for railway sleepers in certain parts of India. As it is, its weight necessitates land carriage and thus increases its cost. But on the Burma line it has answered admirably, and it is also used on some Indian railways. Latterly, quantities of broad gauge sleepers of pyinkado from the Tenasserim forests have been exported to Calcutta, on Government account, as an experiment, and during 1879-80 the results were as follows:

13,515 sleepers, measuring 46,384 cubic feet, cost Rs. 29,336, or at the rate of Rs. 2-2-7 per sleeper. 5,859 sleepers, measuring 20,343 cubic feet, realized Rs. 25,742, or at the rate of Rs. 4-6-3 per sleeper. This experiment should be steadily continued.

Pyinkado is one of the reserved trees of 1876, but it was included among that number entirely with the view of making revenue, and not with the view to its protection—a measure which is not required at present.

33. Padouk *(Pterocarpus indicus)* is widely spread throughout the forests of British Burma, but is nowhere common. The wood is used locally for cart building and other purposes. It is strong, durable, and very handsome, and is less hard and heavy and easier worked than pyinkado. In some forests the consumption of the wood has been greater than its re-production, which is not very vigorous. Accordingly, it has become scarce in some places, and being a valuable wood, for which there is a certain demand at Madras and Bombay, chiefly for gun-carriages, it merits protection and has actually been protected, particularly in Tenasserim, where it is only cut and exported on account of Government.

34. Kokoh *(Albizzia Lebbek)*, the Seriss of India, is also one of the reserved trees of 1876. It attains a large size and is widely spread, but, like padouk, is nowhere common. It is not exported, but is locally used and much valued for cart axles and other purposes.

35. Pymma *(Lagerstræmia Reginae)* is another of the reserved trees of 1876. It is abundant throughout the Province, on low ground and near streams, and though it is a favourite wood, which is most extensively used for house and boat building, it cannot be said that there is any risk of its becoming scarce, except locally in special cases. However, power should be given to protect this kind, in case such should become necessary.

36. Anan *(Fagraea fragrans)* is a wood of Tenasserim, highly valued locally, which was included in the list of reserved trees of 1876, but which is not of sufficient importance to require special notice. Sleepers of anan, as well as of Gangaw *(Mesua ferrea)*, a most valuable tree, with dark-red and most durable heart-wood, which is common in the evergreen forests of South Tenasserim, have of late years been sent to Calcutta as an experiment.

37. Karaway, Kansaw, and Hmantin* are valuable trees of the laurel family in the Tavoy and Mergui Districts, and the wood is in great demand for house-

* Karaway and Hmantin are scented woods, probably species of *Cinnamomum*, allied to the Japan Camphor tree.

building, long lengths of karaway being also in demand for masts of Chinese junks and native craft (kattoos). These trees are not at present reserved, but it is believed that protective measures may have to be taken in regard to them.

38. Akyaw *(Aquilaria Agallocha)*, the famous Eagle-wood, is largely exported to China, where it is used for incense and medicine, whilst larger pieces are worked up into articles of ornament. The tree is found in South Tenasserim. It is also reported from the evergreen hill forests east of Toungoo, but the scented wood is only produced in and exported from the islands of the Mergui Archipelago. The tree attains a very large size; the wood is white, soft, and very perishable. When the wood is injured, when a branch decays naturally or is broken off, or when an insect burrows a hole, or a dah-cut is made in the tree, the same result follows—irregularly shaped masses of hard, scented, brown coloured wood are formed, and this is the eagle-wood of commerce. The trees are cut, the wood is collected by the Selungs, and it is estimated that about 1,000 viss annually are exported, valued at Rs. 10,000, and that 8,000 trees a year are felled to yield this quantity.

The Akyaw trees are getting scarce, and some steps will have to be taken to protect them.

39. Tounpein-nay *(Artocarpus Chaplasha)* is widely spread, but nowhere common, in the evergreen forests throughout Burma. The wood is strong, easily worked, seasons well, and is most durable. It is valued next to Thingan for boat-hulls and for making solid cart wheels, which command a high price. It is not a reserved tree, but may at some future time require protection locally.

**Rules regarding other kinds.**

40. It will be well now briefly to review what has been done, and what still requires to be done, in order to afford protection to valuable trees other than teak. At the outset, when forest conservancy was first started in Pegu and Tenasserim, the protection of teak was the only object aimed at. Thus the Pegu Forest Rules of 1856 relate to teak only. The idea then held was, that the forests which would eventually be demarcated to be permanently maintained as forest, would contain a sufficient supply of the more valuable kinds to meet the requirements of the country and of export trade. At that time it was considered sufficient to provide for the protection of teak. But the increase of population and the development of trade soon rendered further measures necessary. Thus the Burma Forest Rules of 1865 and those of 1876 contain provisions which are intended to protect other trees also. Rule XII. of 1865 gives power to the Chief Commissioner to authorize the levying of duty on trees of other kinds, and to prohibit the interference with such trees, if below a certain size. Rule VIII. of 1876 lays down that the authority of the Forest Department shall, outside the reserved forests, extend to the protection of teak and other reserved kinds.

**Reserved trees.**

41. The first action under Rule XII. of 1865 in regard to timber other than teak was taken in 1873, when Thitkado and Thitka were declared reserved trees, the cutting of which below a certain size and without a permit was prohibited. The use of all other timber and of bamboos was, however, left free to the people, whether for their own consumption or for trade. The waste caused by such a system, the injury to the forests, and the loss of revenue to Government led to further measures in the same direction.

In 1876 the following twelve kinds, in addition to the two named, were declared reserved trees :—

(1) Thingan.
(2) Thitsee.
(3) Kokoh
(4) Pyinkado.
(5) Padouk.
(6) Anan.
(7) Engyin.
(8) Theya.
(9) Eng.
(10) Pymma.
(11) Kanyin.
(12) Sha.

**Rules regarding reserved trees.**

42. The chief provisions relating to these reserved kinds, as laid down in the orders of 8th March 1876, and as modified by subsequent orders, may be briefly stated as follows:

(1) All trees may be cut without let or hindrance in clearing ground *bonâ fide* for the purpose of cultivation.

(2) For other purposes the reserved kinds may only be cut under permits, which are of two kinds—free permits and trade permits.

Free permits are granted, without payment, for all timber or other produce which is used for the domestic or agricultural requirements of the inhabitants of villages in the vicinity of forests. Two conditions were, by subsequent orders of 4th January 1878, attached to these free permits: *first*, that they should not be used to fell or extract any tree growing at a distance of more than five miles from the residence of the permit-holder; and *second*, that timber extracted under a free permit must not be sold or bartered. Trade permits are granted on payment for trees felled and timber reserved for purposes of trade and merchandize. Two rates of revenue for timber were fixed: Rs. 2 per ton of 50 cubic feet for Eng or Pymma, and Rs. 4-8 for the other kinds. Broadly speaking, it may be said that these rates correspond to ten per cent. on the value of the timber at the place where the payment is made. A small fee per tree of four annas in the case of Eng and Pymma, and of eight annas in the case of the other kinds, is paid in addition to these rates before the trees are felled. At the same time it was arranged that permits for the extraction of resin, wood-oil or thitsee, or for the making of cutch and charcoal, should be granted by the Deputy Commissioner of the District.

43. The principle sought to be established was, that, while for purposes of trade people must pay for the timber and forest produce they extract, those who live in the immediate vicinity of the forest should continue to take wood and other forest produce for their domestic and agricultural requirements.

As already explained, several of the trees were included in the reserved list solely or mainly for revenue purposes, but the measure has been beneficial in so far, that timbers not included in the list have been extracted in preference to those thus included.

As regards revenue, the results have been as follows:—

*Pegu Circle.*

| | 1876-77. | 1877-78. | 1878-79. | Total. |
|---|---|---|---|---|
| | Rs. | Rs. | Rs. | Rs. |
| Timber .. ... | 10,037 | 55,125 | 53,926 | 1,19,088 |
| Bamboos ... | .. | 29 | 403 | 432 |
| Cutch . | 15,956 | 20,125 | 12,090 | 48,171 |
| Minor produce ... | 2,248 | 2,164 | 4,924 | 9,336 |
| TOTAL ... | 28,241 | 77,443 | 71,343 | 1,77,027 |

*Tenasserim Circle.*

| | | | | |
|---|---|---|---|---|
| Timber ... ... | 596 | 6,550 | 10,693 | 17,839 |
| Minor produce ... | ... | 950 | 1,145 | 2,095 |
| TOTAL ... | 596 | 7,500 | 11,838 | 19,934 |

**Objections to system.**

44. But the maintenance of so large a number of reserved trees and the system generally is cumbersome, and may now with advantage be simplified. Free permits have been issued with the greatest liberality, several hundred logs having sometimes been given away on a single application. Consequently there has been much abuse and waste. On the other hand, the necessity of taking out free permits for timber required for home consumption must lead and has led to extortion and peculation.

**Modified system proposed.**

45. A more simple plan appears to be, to dispense with free permits altogether and to tax all timber and forest produce of whatever kind it may be, which is extracted from the forests for purposes of trade. If this principle is adopted, there will be no interference with trees cut in clearing ground for purposes of cultivation, and by people living within a moderate distance, which may at present be fixed at five miles, from the forests for their own domestic and agricultural requirements, the only exceptions being teak and such other kinds as may in certain localities require special protection.

Revenue for minor produce should continue to be levied in the same manner as at present, although the rates might with advantage be raised in some cases. Cutch manufacturers, for instance, should pay double the present rate, or, say, Rs. 20 per cauldron for the season. On all timber and bamboos removed from the forests for purposes of trade revenue should be paid on passing certain revenue stations, or on entering large towns and villages situated at a distance from the forests. It is suggested that these rates be raised to a higher figure in the case of such kinds as it may be desirable to protect. Thus thingan might well pay Rs. 10 per ton of 50 cubic feet, for a high rate like this would induce people to use other woods in the place of thingan.

For bamboos the rate should be low, and perhaps it will be convenient to adopt two classes, which might pay at the rate of 8 annas per 100 the first and 4 annas per 100 the second class. But it is not proposed that there should be a uniform scale of rates for the whole province; the rates of revenue must be regulated by local circumstances, which will be found to differ in each district.

In the case of timber and of fire-wood and charcoal exported for sale in large quantities, trade permits would be taken out as at present. It should be made clear, that trade permits must be taken out and revenue paid for all timber exported for sale, whether such timber was originally cut on land cleared for cultivation or not.

46. I do not advocate the retention of the present list of fourteen kinds (besides teak) as reserved trees all over the province. From what has been explained, it will be understood that the number of trees requiring protection everywhere is very small, thingan and padouk being perhaps the only kinds which should be specially protected throughout the province. But power should be given to protect trees locally in certain districts, in case necessity for doing so should arise. In fact, with the exception of teak and perhaps the two kinds named, no trees should be reserved throughout the province; but such measures regarding the protection of particular kinds should be taken as may appear requisite in each district or locality.

**The permanent supply of valuable kinds can only be secured in demarcated reserves.**

47. If judiciously carried out, the measures here suggested may secure the protection of certain kinds in certain localities. But a permanent supply can only be secured by including within the demarcated reserves forests producing the kinds of which it is desired to maintain a perpetual supply. This of course must be a work of time. It would, as a rule, not be expedient to demarcate large areas to be permanently maintained as forest, unless it were certain that the produce of those areas will be required to satisfy local demands, or to supply material for export trade. Of teak it may be regarded as certain that the demand for the wood will always be considerable, and will not fall short of the supply. But, with the exception perhaps of cutch and thingan, this cannot yet be said of any other trees found in Burma.

48. As above explained, a beginning has already been made in the Yoonzaleen Valley to demarcate a forest chiefly with the view of providing a supply of thingan and thitka; and proposals have been recommended in this report, and on previous occasions, to set apart a large area of reserved forest north of Rangoon for the supply of fire-wood and charcoal and for general purposes. As opportunity may offer, other areas similarly situated should be selected and demarcated, and a similar plan should be followed with regard to cutch-producing forests in the Irawaddy Valley. But we are quite unable

at the present time to form any correct ideas regarding the future development of the demand for other kinds of timber and forest produce, and any scheme for making a survey, at the present time, of the available forest resources of British Burma, and determining the areas which should be permanently maintained as forest outside the tracts which produce teak and a few other tracts selected for special purposes, must be designated as visionary and utopian.

**Measures for developing the demand for other kinds of timber and forest produce.**

49. It is, however, in every respect desirable that the demand for timber of other kinds and for other produce of the Burma forests should be developed as much as possible. As long ago as 1860, a commencement in this respect was made. A quantity of woods of many kinds likely to prove useful was brought down on Government account from the Pegu forests to the Government timber depôt at Rangoon and sold as an experiment, chiefly with the view of bringing other kinds of timber to public notice.

These operations at that time yielded no profit, nor could this be expected at the outset. But they were useful in some respects, and one wood, thitka *(Pentace burmanica)*, formerly quite unknown, was discovered to be a wood likely to be useful for cigar boxes, tea boxes, and furniture. A demand gradually sprang up for several kinds, and the operations which were resumed a few years ago now yield a fair surplus. According to data furnished by the Conservator of Forests, the following have been the receipts and charges on account of timbers of other kinds (not teak) extracted and sold on Government account during the last three years:

| | | 1876-77. | 1877-78. | 1878-79. | Total. |
|---|---|---|---|---|---|
| | | Rs. | Rs. | Rs. | Rs. |
| Pegu .. | expended . ... | 17,189 | 31,178 | 21,891 | 70,258 |
| | realized ... ... | 72,943 | 56,697 | 26,504 | 1,56,144 |
| Tenasserim | expended .. ... | 11,911 | .. | 30,699 | 42,610 |
| | realized .. . | 9,952 | 24,780 | 12,855 | 47,587 |

During these three years, therefore, Rs. 2,03,731 have been realized on this account, against an outlay of Rs. 1,12,868.

50. The quantity and descriptions of timber other than teak extracted on account of Government during the same period was as follows:

*Timber (not teak) extracted on Government account (in tons of 50 cubic feet)*, 1876-77 *to* 1878-79.

| Particulars. | 1876-77. | | | 1877-78. | | | 1878-79. | | | Total. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pegu. | Tenasserim. | Total. | Pegu. | Tenasserim. | Total. | Pegu. | Tenasserim. | Total. | Pegu. | Tenasserim. | Total. |
| Eng ... ... | ... | ... | .. | ... | ... | ... | 80 | . | 80 | 80 | ... | 80 |
| Engyin and Theya . | 46 | .. | 46 | 132 | . | 132 | 8 | ... | 8 | 186 | . | 186 |
| Thingan . | . | . | .. | | . | .. | . . | 37 | 37 | . | 37 | 37 |
| Thitka and Thitkado .. | 1,127 | 337 | 1,464 | 2,204 | 1 | 2,205 | 652 | 105 | 757 | 3,983 | 443 | 4,426 |
| Sha | .. | .. | ... | ... | . | | 97 | .. | 97 | 97 | . | 97 |
| Padouk .. | 43 | 240 | 283 | .. | 173 | 173 | . | 130 | 130 | 43 | 543 | 586 |
| Pyinkado ... .. | 516 | 132 | 648 | 11 | | 11 | 66 | 40 | 106 | 593 | 172 | 765 |
| Laizah, Kanyin and Pymma | 22 | ... | 22 | 47 | ... | 47 | 276 | ... | 276 | 345 | .. | 345 |
| Other kinds .. . | 79 | 84 | 163 | 610 | 71 | 681 | 307 | 435 | 742 | 996 | 590 | 1,586 |
| Total ... | 1,833 | 793 | 2,626 | 3,004 | 245 | 3,249 | 1,486 | 747 | 2,233 | 6,323 | 1,785 | 8,108 |

**These measures should be continued.**

51. Similar operations should be steadily continued, for, apart from their yielding revenue, they will tend to develop a demand for different kinds of timber. It might be objected that operations like these should be left to private enterprize. The difficulty is, that private enterprize has not the special knowledge at its command which the Forest Department of Burma possesses, and that the tendencies of trade are essentially conservative; so that Government, by endeavouring to make new kinds of timber available for the market, engages in work which is not likely to be undertaken by others. Of forest produce which may perhaps become an article of trade hereafter, it may be useful to mention the fruit of the Pangah (*Terminalia tomentella*, Kurz), which is similar to the Myrobalans, the fruit of the Indian Harra (*Terminalia Chebula*), now an important article of export from the forests of the Western Ghats in Kanara and of the hills of Central India. It is not improbable that pangah may be accepted by the trade as a substitute of the Indian myrobalans. It is for the forest officers in Burma to take the first steps in this matter.

**Denudation.**

52. Burma is as yet essentially a forest country, more than any other province of India, and the evil effects of denudation have not yet been experienced to any great extent. But cultivation is spreading rapidly, and the time will doubtless come when the destruction of all forest in the open country will be felt as a difficulty. Already there is reason to believe that the absence of shade and shelter, and the scarcity of grass during the hot weather, have been the cause of cattle disease, which threatens to be a real difficulty in some districts.

And the practice of continuous burning and cutting of toungyas on the hot and dry hills of the Prome and Thayetmyo Districts must sooner or later have an injurious effect upon the fertility of those districts. With regard to the effects of denudation in the Prome District, between the Irawaddy River and the hills of the Pegu Yoma, I cannot do better than quote the following passage from Mr. Baden-Powell's able Report on the forests of Burma, of September 1873:

37. The forest is green and shady till about the month of March, when the trees and bamboos shed their leaves, and the forest is open and hot till the showers fall in May.

This is true of the whole hill ranges up to the north of the Tharawaddy Division, below Prome.

38. Far other is the dreary sight that meets the traveller on entering the Prome District: here, though it was but January, when the Tharawaddy was green and cool, the outer ranges of the Prome hills were one mass of bare stems and without foliage. The bamboos through which we passed were white and dry, the ground under it, totally uncovered by any herbage, dry and cracked. Elsewhere a rank but sparse jungle covered the ground.. Here and there a few blackened stumps and occasional bare girdled stems marked where high forest once had been and is now no more. All the outer hills are like this. A peculiar whitish dried up tint prevails over the whole landscape; only occasional bits of cotton cultivation present a green fresh appearance that makes the rest look more bare by contrast.

The sunshine, even in January, is oppressive; the cart-tracks, which are numerous, wind through the miserable vegetation of the "poonzohs" (that is, sites of toungyas); the dust is suffocating, for not a tree stands by the way side, and the toungya is cut close to the track. The dewfall, so abundant in the Tharawaddy as to drip on to our tents in the early dawn from the trees overhead as if raining, was greatly diminished, and indeed in places totally absent.* The inner ranges alone retain their condition, and here population

* The description of Eastern Prome is borne out by Mr. Theobald, who says: "There is no physical reason that I am aware of, either in the shape of the hills or their composition, for the great contrast which exists between the outer and inner hills in Eastern Prome. Yet nothing can be more striking. Within the inner hills, that is, beyond the line of villages and the range to which the clearings have reached, the trees retain their freshness during the greater part of the year, and even in the hot months present a grateful shade; whilst in the outer hills ..... the few trees of any size that occur are smaller than usual and with the stunted appearance of arrested development, which, viewed in conjunction with the generally parched aspect of the vegetation over the whole tract, can only be referred to the injurious climatic results of indiscriminate clearings, and the great diminution of atmospheric humidity and increase of atmospheric temperature thus brought about."

has not yet spread, so that the forest has not been sacrificed. Where the teak forest has been reserved the quality is good, showing that the soil of Prome is not at fault; if the growth is somewhat slower, owing to the less degree of moisture, the boles are round and well developed.

Thus it may be anticipated that in Burma also, as in other provinces of India, the protection of forest growth will be found to be necessary for general reasons, apart from the timber, wood, and other forest produce yielded by them. The most economical and effective plan for guarding against denudation in the open country will probably be the formation of village forests, and a commencement in this respect has already been made by the allotment of grazing grounds to villages and groups of villages under the Burma Land and Revenue Act. Much more, however, requires to be done, but this must wait until more progress has been made with the more urgent work of demarcating a sufficient area of teak-producing forest.

**Forest revenue.**

53. Recapitulating what has here been advanced, it is clear that the chief objects of forest conservancy in Burma are—the production of a permanent supply of teak timber for local requirements and for export, the production continuously of a sufficient supply of other woods and other produce, and the prevention of the evil effects of denudation. It is also clear that revenue must be realised, in order to cover the cost of forest conservancy. Hitherto forest administration in Burma has paid very well. The financial results of the last 23 years, arranged in five periods of three and five years each, will be seen from the following figures, giving the mean annual receipts and charges of forest management in Burma from 1856-57 to 1878-79:

| Periods. | Receipts. | Charges. | Surplus. |
|---|---|---|---|
| | Rs. | Rs. | Rs. |
| Three years, 1856-57 to 1858-59 ... ... | 2,23,049 | 2,23,904 | *Def.* 855 |
| Five years, 1859-60 to 1863-64 .. ... | 4,22,914 | 2,71,170 | 1,51,744 |
| Ditto 1864-65 to 1868-69 . ... | 7,44,535 | 3,22,199 | 4,22,336 |
| Ditto 1869-70 to 1873-74 . ... | 8,94,277 | 4,02,240 | 4,92,037 |
| Ditto 1874-75 to 1878-79 .. ... | 14,29,175 | 8,11,330 | 6,17,845 |
| Average of the last 15 years ... ... | 10,22,662 | 5,11,923 | 5,10,739 |

**Must be increased.**

54. After the first three years of preparatory work without surplus, the mean annual surplus has increased steadily from Rs. 1,51,744 to Rs. 6,17,845. But as the demarcation of the reserved forests progresses, and as planting and other operations of improvement are extended, the expenses must necessarily increase largely. This is unavoidable. Without heavy outlay continued over a long series of years, the Burma forests cannot be placed in a position to supply a large proportion of the teak timber annually consumed. Again, many of the reserves which have been demarcated, or which are about to be demarcated, have been impoverished by reckless cutting in former years. Teak must now be cut most sparingly, and large areas will yield very little or no revenue for many years to come. Hence it is necessary, in order to cover the cost of forest conservancy in Burma, that a larger revenue than hitherto be realized from the forests outside the demarcated reserves, and this it is proposed to effect by levying revenue on all timber and forest produce extracted for purposes of trade and merchandize. The measures proposed in this respect will in no way interfere with the extension of cultivation; they will impose a small tax upon a trade which is most profitable, and they will to some extent tend to diminish waste of useful material and to protect certain kinds of trees which are specially valuable.

## CHAPTER II.

### LEGISLATION.

55. All unalienated forest land in British Burma is, with all the trees growing upon it and other produce yielded by it, the property of Government, subject only to such prescriptive rights of occupancy in deserted fields, of way, and of user as may belong to the agricultural population in the vicinity of the forests. The rights of Government as proprietor of the forests have been asserted in the different portions of the province ever since they became British territory. Government has the unrestricted disposal of all forests and waste in British Burma for cultivation or other purposes. If further proof were needed, it would be found in the grants made under the Waste Land Grant Rules of large areas of waste and forest, without any reservation. In Arakan the forest rights of Government have been asserted by the issue of forest rules regulating the cutting of iron-wood trees. In Tenasserim and Pegu they have mainly been exercised with regard to teak, which ever since annexation has been considered a Royal tree and the property of Government in the whole of British Burma. In Pegu the forest rights of Government were formally asserted after annexation, by a proclamation, dated the 26th September 1853, which declared all forests in the province the property of Government, and prohibited the cutting, marking, or felling of teak timber. In Pegu and Tenasserim, including Martaban, Government undertook the control of all forests and regulated that control by the issue of forest rules. The first forest rules for Pegu are dated the 20th October 1856.

In Tenasserim duty has been levied on teak timber, whether the produce of British or of foreign forests, ever since 1829. After several modifications this duty was fixed in 1848 by the Government of India at Rs. 4 for every full-sized log brought down the Attaran, and at Rs. 2-12 for every log brought down the other rivers to Moulmein, and these rates were maintained until 1873.

#### Rules of 1865.

56. In 1865 the Burma forest rules were promulgated under the Government Forest Act of that year (Act VII. of 1865). The provisions of these rules were not, however, made applicable to the whole of the forests under the control of Government, but only to what were called Government forests, which comprised a large portion of the country, and were defined partly by natural, partly by artificial boundary lines. These rules, though purporting to have been made under the Government Forest Act, were not covered by its provisions, and accordingly they were legalized by Act VII. of 1869. In 1873 it was deemed advisable to amend and consolidate the law relating to timber floated down the rivers of Burma and to duty on foreign timber, and the Burma Timber Act of 1873 was framed accordingly. This Act repealed those sections of Act XXX. of 1854 which related to the same subject. It also repealed Act VII. of 1869 and the forest rules legalized by it, as far as they related to duty on timber. By notification under this Act of 31st March 1874, the duty on foreign timber was altered into an *ad valorem* duty.

#### Rules of 1876.

57. Lastly, in November 1875, the Government of India sanctioned a fresh set of rules under the Government Forest Act of 1865, intended to apply to those Government forests which were not provided for by the Rules of 1865.

These rules were promulgated in Burma on the 30th March 1876, together with a notification defining the areas to which they were made applicable.

58. The forests in the Pegu and Tenasserim Divisions of British Burma are thus subject to forest rules in the following manner:

*Subject to the Rules of* 1865.—The forests on both sides of the Pegu Yoma Range and in the Sitang Valley, comprising the most important forests of Pegu east of the Irawaddy River; and the Beeling, Yoonzaleen, Doomdamee, Thoungyeen, and Attaran forests in the Tenasserim Division.

*Subject to the Rules of* 1876.—The Pegu forests west of the Irawaddy River; and in Tenasserim the Shwaygyeen, Upper Salween, Hlinebway, Houndraw, Lower Amherst, Tavoy, and Mergui forests.

**Teak a Royal tree.**

59. There are, however, large areas of forest, not included within these limits, which are the property of Government, and which are as such protected by the law, although no special forest rules are applicable to them. In these lands, as well as in the Government forests, teak has always been regarded, and is still regarded, as a royal tree. Broadly speaking, it may be said that Government is regarded as the owner of all teak trees in the province, except those standing in private gardens and other enclosures. On waste land and forest land Government has exercised and does exercise absolute control over all teak trees. There are, however, exceptions which should be noted. Thus, in the Attaran and Pandaw forests of Tenasserim private rights in teak have been granted, and some hilly tracts between the Sitang and Salween Rivers have been expressly exempted from the operation of certain sections of the Forest Rules relating to teak.

60. Again, in some districts, as in the Thayetmyo District west of the Irawaddy River and in the Upper Salween forests, the protection of teak has not been enforced at all, or only in a very imperfect manner; and in such districts the rules have practically been in abeyance. As a rule, however, while there has been no interference with teak trees growing on private lands, it is recognized that Government has certain rights with regard to teak in Burma, and, as a matter of fact, the tree has been more or less protected throughout the country.

**General protection of Teak beneficial.**

61. This general protection of teak has been most beneficial. It has promoted the growth of the tree, and it will thus tend to increase the supply of teak timber in future, even from forests outside the demarcated reserves, which is a matter of very great importance. It has also tended to preserve the forest generally in the vicinity of paddy fields and other cultivated lands—a great boon to the people in the open country, as these groves and small forest areas, which owe their existence to the protection of teak in them, furnish the people with wood, grass, and shade for their cattle. The greatest caution should be used not to abolish or to modify hastily a well-understood and universally accepted principle—that of the Government right to all teak trees in Burma.

**The position of Government in regard to Teak should be better defined.**

62. On the other hand, the rapid extension of cultivation and the improvement of communications demand that the matter should be more clearly understood than it is at present.

The following are the main points which should be kept in view in regard to this matter:

**Teak in Toungyas.**

63. The present rule must be maintained which, as regards Government forests, is embodied in section IX. of the Rules of 1865 and in section X. of the Rules of 1876, *viz.*, that no clearings for Toungya cultivation must be made on any Government land on which stand teak trees. At the same time, the Chief Commissioner must retain the power, which he has at present, of exempting any forest district from the operation of this rule.

**Teak standing near fields and villages.**

64. Teak does not generally stand in the midst of paddy fields; in fact, the tree cannot live on a paddy field; and if a forest containing teak is cleared and converted into a wet paddy field, any teak trees left standing on the field die in a few years. But teak trees are not uncommonly found on the edges of paddy fields, and on stretches of high ground which intervene between paddy fields. Again, teak trees are found in gardens, and between the houses in villages. Under the existing practice such trees are regarded as the property

of Government, and this view should be maintained until Government have distinctly relinquished their right to them. In most cases, if an enquiry were made, the land would probably be found to be Government waste and not included in the measured revenue-paying area. But *primâ facie*, and until the contrary is proved, teak growing on the edge of fields, on high ground between fields, and near villages, should be assumed to be Government property.

65. Every facility should, however, be afforded to landholders who may desire to purchase teak trees standing near their fields. Such teak trees should be sold by the District Forest Officer, acting under the control of the Deputy Commissioner and the Conservator of Forests. It should rest with the Conservator, in consultation with the Deputy Commissioner, to fix the rates to be paid for standing teak trees in different portions of the district.

**Fresh grants of land for cultivation.**

66. Without the previous sanction of the Chief Commissioner no grant should be made of land bearing teak trees, and such grants should, as a rule, not be made of hilly ground or of land which is unfit for gardens or paddy cultivation. Land with teak trees should not be granted, if there is any reason to apprehend that the grant of such land will increase the difficulty of protecting any Government forest. No right in teak trees standing on grazing grounds allotted to villages under section 28 of the Revenue Rules should be granted. The District Forest Officer should be consulted in the case of all such grants of land containing teak trees, and in cases of doubt it should rest with the Conservator, subject of course to the Chief Commissioner's orders, to decide whether such land should be granted or not.

**Teak planted by private persons.**

67. In cases where persons have planted teak on Government land, a grant may, on application, be made to them of such land, provided the land is not included in any reserved or village forests, or in any grazing grounds allotted under section 28 of the Revenue Rules. In the case of such grants no payment should be required for the teak trees standing on the ground; the land may be exempted from assessment for a period of, say, eight years from the time of planting; and the rate of revenue per acre should be one-half of the rate chargeable for paddy land in the vicinity.

**General remarks.**

68. In considering this matter it should be remembered that, in the Bombay Presidency, Government has in most districts retained full proprietary right over teak trees standing on lands allotted to villages for ráb (ash manure) and for grazing, and that it retains a lien on teak trees standing upon occupied lands. In those districts of the Bombay Presidency where these rights of Government to teak have not been maintained, the protection of the Government forests is found to be extremely difficult.

I do not recommend that Government should assert its right to teak on private lands in Burma; but I beg to urge the greatest caution in disposing of the rights of Government to teak trees standing on land which is not clearly private property.

69. The task of forest administration in Burma is an extremely difficult one, *viz.*, to bring a limited area of teak-producing forest into such a condition that it will eventually be capable of yielding a large portion of the teak timber annually required for local consumption and for export. At first sight it might be thought that our task might be facilitated by encouraging the production of teak in private forests. But the experience hitherto gained in Burma has been, that forests in private hands are ruined and exhausted within a short period. Moreover, the existence of private forests in the vicinity of Government forests in a country like Burma introduces serious difficulties in the matter of protection, which must be guarded against in order to ensure the economical and efficient protection of Government forests. At present at least, all standing teak trees in the vicinity of the forests, in the hands of private persons, are likely to make protection more difficult and expensive. Circumstances may change, but the suggestions here submitted are necessary at the present time.

70. An important feature in the Forest Rules of 1865, which has been somewhat lost sight of in late years, is the provision which authorized the Conservator of Forests to grant teak timber gratuitously to persons residing in the district, near the forests, and at a distance from the principal rivers, for the erection of kyoungs, zayats, bridges, chapels, school-houses and other buildings for the common benefit of the public. By a judicious application of this rule large quantities of teak timber of no great value, scattered about the country, were turned to useful account, while giving satisfaction to the people residing in the vicinity of the forests. The stringency of the rules regarding teak was thus felt much less than it would otherwise have been. Under lax control the rule may have been abused, but there was no difficulty before 1862; on the contrary, the operation of the rule was felt to be most beneficial.

The object is to utilize teak timber of inferior quality which otherwise must perish in the jungle fires, and to utilize it in a manner which shall conciliate the people living in the vicinity of the forests.

#### Necessity of Legislation.

71. What has been stated at the outset of this chapter regarding the Forest Rules now in force in Burma will have made it clear that fresh forest legislation for this Province is necessary. The Indian Forest Act has not been extended to Burma, and its provisions are not applicable, chiefly for two reasons—

*First*, the procedure to be laid down by law to regulate the demarcation of reserved forests and settlement of rights in Burma ought to be framed in accordance with the existing procedure, as it has been developed by the practical experience of the last five years.

*Second*, the provisions of the Indian Act relating to "Protected Forests" are not applicable to Burma. We cannot undertake to define two classes of Government forests—protected and reserved forests; and what is required is, that the position of Government in regard to forest on all lands which are not private property should be clearly defined.

Thus it will be necessary to pass a special Forest Act for Burma.

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## CHAPTER III.

### RESERVED FORESTS.

72. In the first Forest Rules framed for Pegu in 1856, the formation of reserved forests was provided for. But the task of organizing a regular forest administration in a new province, and against much opposition, left neither time nor leisure for selecting and demarcating reserved forests. It was necessary, in the first instance, to produce revenue, in order to justify the necessary outlay for establishments and to secure for the new business the confidence of Government. In those days the policy which Government would follow in forest matters was by no means settled. In 1861 the Government of India ordered a large portion of the forests to be thrown open to private enterprize, and it was not until sometime afterwards that matters appeared sufficiently settled to justify a commencement in earnest in demarcat-

ing reserves to be permanently maintained as forest. The following is an extract from a joint memorandum, dated Rangoon, the 10th June 1864, by the then Chief Commissioner, Lieutenant-Colonel (now Sir) Arthur Phayre, and the writer of the present report, prescribing the procedure for carrying on the demarcation of reserved forests :—

In the following remarks the Chief Commissioner of British Burma and the Inspector General of Forests propose to lay down their views on certain points concerning the management of the forests in British Burma.

Having regard to the 9th and 10th paragraphs of the letter from the Government of India, No. 16 F, dated the 11th April 1864, it would appear that the demarcation of the reserved forests will be the first step to take preparatory to the formation of compact teak forests.

In these reserved forests no toungya cultivation will be permitted, and no other interference with the forests of whatsoever kind, and every endeavour should be made gradually to improve them, and so to increase the proportion of teak growing in them as gradually to transform them into compact teak forests.

In accordance with the established practice, girdling operations and work for the improvement of the forests will annually be conducted in certain portions of the forest divisions; and it appears expedient that the selection and demarcation of reserved forests should take place simultaneously with these girdling operations.

The following procedure is proposed to be followed :

The forest officers will select the tracts and demarcate them by temporary boundary marks in a preliminary manner.

If no maps of the forest districts are available, sufficiently reliable and detailed, a survey must be made, and a plan of the locality prepared. A scale of two inches to the mile appears suitable for these plans. The position of the different reserved tracts must be entered on a map of the district.

The forest officer should send due notice to the Deputy Commissioner of the district of the forest tracts where, and the time when, he intends carrying on the work of preliminary demarcation; and the Deputy Commissioner should, if practicable, depute an officer to the locality while the work is progressing. But the forest officer, after having given due notice, will not be obliged to wait, or to delay his operations.

At the close of the working season the forest officer would then prepare his plans and maps, and draw up a descriptive report of the reserved tracts demarcated by him; the report would exhibit the reasons for making the reservation, a description of the boundaries and boundary marks, and the number of inhabitants, if any, within the tract. In case of forest tracts in area below 100 acres, and not containing any houses or cultivation, it appears expedient to authorise forest officers, under the control of the Conservator, to demarcate them finally, and at once to put up permanent boundary marks. But a plan, maps and report should be submitted in every instance; and the demarcation would be subject to the sanction of the Chief Commissioner.

These documents should first be submitted to the Conservator of Forests for his approval.

They will then be sent to the Deputy Commissioner of the district, who will submit them with his report to the Commissioner of the division. This report should, if possible, reach the Chief Commissioner about September. The Chief Commissioner will then pass his orders. On receipt of the Chief Commissioner's sanction to the reservation of any forest tracts, the Deputy Commissioner will issue a notice, informing the inhabitants of the vicinity that the tracts in question have been transferred to the Forest Department, and that no toungya cultivation, or other interference with the forest, will be permitted. The boundary marks will then be made permanent, and it will then be the duty of the forest officers to clear a path along the boundary line of the forest, and this path should be cleared every year at the commencement of the dry season.

As it appears necessary to guard against toungya cutting in the tracts selected previous to the final demarcation, the Deputy Commissioner will be authorised to prohibit this cultivation for one season in the forests thus selected and demarcated in a preliminary manner.

It is not thought expedient to fix a minimum or maximum size of the tracts proposed to be reserved, but it may be said that at the outset no tracts should be reserved smaller than 50 acres or larger than 15 square miles. The growth of the teak in the forests, the stock of

timber growing on the ground, and the situation of the locality as offering facilities for the transport of timber, would be the principal points to be considered in the selection of these tracts, and, in order to show that these points have received due consideration, they should be discussed in the report which will be submitted to the Chief Commissioner. This will entail valuation surveys of portions of average quality in these tracts.

* * * * * *

About the same time the forest rules for British Burma were re-drafted in the form in which they were afterwards sanctioned by the Government of India under the Government Forest Act of 1865, and a separate chapter (III.) was framed, which contained detailed provisions regarding reserved forests. Schedule I. appended to those rules defined the procedure to be observed in demarcating reserved forests.

**Opposition against the formation of Reserved Forests.**

73. But after Sir A. Phayre left the province, there was much local opposition against the formation of reserved forests, and for a long time no real progress in this respect was made. It was maintained that the natural forests were extremely poor, remote, and difficult to work, and that no good could be attained by attempting their protection and improvement. On the other hand, it was urged that plantations of teak, in localities easy of access and easy to work, could be made on a large scale at a moderate expense, and that the requirements of the future in the matter of teak timber should be provided for by making plantations of that tree on a large scale. These views prevailed during a series of years, and the result was that during that period no real progress was made in demarcating reserved forests. In 1868 the writer of the present report inspected a portion of the Pegu forests, and, in the report which he submitted as the result of this inspection, he again urged the selection and demarcation of reserved forests on a sufficiently large scale.

**Mr. Baden-Powell's proposals.**

74. At the end of 1872 Mr. Baden-Powell, when officiating as Inspector General of Forests, was deputed to Burma in order to assist in the prosecution of certain permit-holders, who had unlawfully girdled large quantities of timber in the forests worked by them under permit; and he also strongly urged that the demarcation of reserved forests should be pushed on as rapidly as possible. There was, however, this difficulty, that Mr. Baden-Powell proposed two classes of reserved forests: *Ordinary Reserves*, to be partially protected; and *Special Reserves*, selected areas of limited extent, to be strictly protected and carefully improved. In accordance with these proposals large areas were selected and demarcated as ordinary reserves; but further experience showed that the maintenance of two separate classes of reserved forests was impracticable; and it was decided in 1876, in consequence of a tour of inspection made by the writer of the present report, to revert to the original plan and to establish only one class of reserved forests.

The rights of the people in ordinary reserves had not been enquired into and settled. Toungya cultivation continued almost unchecked in the forests demarcated as ordinary reserves, and thus much of the work supposed to have been done had to be gone over again.

**Progress since 1876.**

75. Hence it may be said that in the demarcation of forests to be permanently maintained as such, no considerable progress was made before 1876. Since then, however, much has been done. The demarcated reserves on the 31st March 1880 aggregated 1,612 square miles, including 170 square miles allotted to Karens for toungya cultivation. With few exceptions, the whole of these reserved forests are situated in the area to which the Forest Rules of 1865 have been made applicable.

**Present procedure.**

76. The procedure in selecting these reserved forests has been as follows. The forest is first examined by the forest officer, and the boundaries

of the proposed reserve are selected. These proposals, if generally approved by the Chief Commissioner, are examined in detail on the spot by a civil officer, who is the Forest Settlement Officer. It is his duty to enquire into any rights in the proposed reserve claimed by the people in the vicinity of the forest, or otherwise found to exist, and to prepare proposals for the settlement of these rights in an equitable manner. The Forest Settlement Officer has also to examine on the spot the requirements of the surrounding villages in the matter of timber, bamboos, and other forest produce, and to suggest arrangements by which these requirements may be satisfied. The Forest Settlement Officer is either the Deputy Commissioner of the district or an officer specially appointed. Associated with him is a forest officer, and these two officers form what is termed the demarcation staff. Whenever necessary, the proposed boundaries of the reserve are modified, so as to exclude an area of forest sufficient for the requirements of the people in the vicinity and for the exercise of their forest rights. The result of the enquiry is submitted, by the two officers mentioned, either in separate reports or in a joint report. These reports are accompanied by a sketch map, which is generally drawn on the scale of half an inch to the mile. This sketch map is based upon the best data available, and on it are entered the principal natural features of the country, all villages and Karen hamlets situated in the forest and in its immediate vicinity, all roads and paths, and the proposed boundaries of the reserve and of any areas proposed to be assigned in it to the Karens for toungya cultivation.

77. The report, after having been examined by the Deputy Commissioner of the district and the Commissioner of the division, is then submitted, with the remarks of these officers and the recommendations of the Conservator, to the Chief Commissioner, with whom it rests, both under the rules of 1865 and under those of 1876, to pass final orders. On sanction being accorded to the demarcation of any reserved forest, a statement of its boundaries and of the rights granted in it is drawn up and is published in the local *Gazette*. This procedure has answered well. It secures the consideration in detail of all interests affected by the demarcation of the reserve. It is lengthy and somewhat costly, but the interests at stake are important, and it is necessary that they should be considered on the spot in detail, and that the people should see with their own eyes that every effort is being made to effect this forest settlement with due regard to their interests.

In the new Forest Act which has been proposed for British Burma, it should be provided that the reserved forests, which have been demarcated and declared under the existing practice, shall be recognized as reserved forests in the sense of the new Act.

**Rights granted in Reserved Forests.**

78. In the manner here described, a most careful examination has been made, jointly by civil and forest officers, of extensive forest areas in Pegu and Tenasserim; and the result of this enquiry has been that large areas of teak-producing forest have been thrown out and excluded from the demarcated reserves. Where it was not possible in this manner—viz., by excluding forest land—to provide for the requirements of the people near the forests, certain rights have been granted to the villages in the vicinity of reserves, and of these the most important are—

(1) the right to pasture cattle in defined areas;

(2) the right to cut bamboos for their own consumption, but not for sale;

(3) the right to collect the leaves of palms, such as the Zalooben (*Licuala peltata*, Roxb.) and Toung Htan (*Livistona speciosa*, Kurz), for thatch;

(4) the right to cut timber for house posts.

(5) In a few instances the right has been granted to take the bark of the Shawben (*Sterculia*) for rope-making for their own use.

The exercise of such user has in some instances been granted as a right, in others as a privilege. Strictly speaking, specific rights can be proved to exist in a few cases only. But in dealing with these questions in Burma, the practice has not been to deny a right when, according to our system of law, no such right can be proved; but the object aimed at was, how to satisfy the *bonâ fide* requirements of the people in the matter of pasture and forest produce.

In no instance, however, has the right of cutting toungyas been granted outside the Karen areas specially assigned for this purpose.

**Rights of user to the extent sanctioned not injurious.**

79. The rights which have been granted, as the result of these enquiries, cannot possibly do any harm. Grazing in the Burma forests is generally carried on during the rains, and there is, therefore, no risk from fire. In the fire-protected blocks it could, as a matter of course, only be allowed at that season. It may here be stated, as the result of the observations made during my tour, that in those districts where demarcation has been completed, the teak-producing tracts excluded from the reserves have improved wherever the people have not cut toungyas, but have been satisfied with the cutting of bamboos and other trees for building and other purposes. In future demarcations it will be well to retain the outer belt of teak-producing forest, and in this outer belt to give up the right of cutting bamboos and timber of other kinds for the requirements of the adjoining villages. I do not at present advocate any alteration of boundaries already fixed in the Tharawaddy and Prome Districts, but the matter deserves serious consideration when new reserves are being demarcated. The rights here proposed to be granted are quite different from the right of cutting toungyas, which is purely destructive, and which must on no account be permitted in the reserves, save in the areas specially assigned for toungya cultivation.

**Valuable forests excluded from reserves.**

80. On my tour I visited a large extent of excellent teak forest outside the reserves in the Tharawaddy District, and I desire here particularly to bring to notice the extensive and valuable forests of teak poles, often 80 to 100 feet high and from three to four feet in girth, which are found on the outer hills and on the undulating ground outside the south-western boundary of the Thoonzai and the western boundary of the Koon Beeling and Boben reserves, as well as in the Toungnyo Valley outside the reserves. In some cases these excluded tracts are much more valuable than the adjoining forest within the limits of the reserves. As long as teak is protected, as at present, and no toungyas are cut within these areas, and as long as the land is not granted away, the teak growing upon it can be utilized, and the young trees may be expected to grow up to marketable size, although, as a matter of course, as long as such forest land is outside the reserved forests, no arrangements for its protection from fire and for the improvement of its condition can be made.

**Risk from toungyas and alienation.**

81. But there is no security against destruction by toungya cultivation; and as regards preventing the land being granted, this will be difficult. Such young teak forest close to the open country is extremely valuable, and people might well afford to pay a moderate revenue per acre, especially if an exemption of revenue for the first eight or ten years were obtained. It would be a profitable speculation to take a grant of such land, under the revenue rules, for the purpose of planting palms or fruit-bearing trees or other garden produce. There would be an exemption of ten years, and at the end of that time some of the teak now standing on the ground would be marketable, and the cuttings would pay over and over again for the revenue with which the land would be assessed. Some safeguard against the alienation by Government of such forest land, in close proximity to the reserved forests, might be provided by requiring the

previous sanction of the Chief Commissioner to the grant of any land bearing teak, and by providing that payment shall be made for all teak trees standing on land granted for cultivation. But orders to this effect have not yet issued, and in out-of-the-way places it will always be difficult, by any rules that may be made, to guard against the alienation of valuable forest land. It is not uncommon for Burmans to put down teak seed or to plant young teak trees. A case lately happened, in which a cultivator residing near the borders of the Mokka Beeling reserve had in 1867 scattered teak seed on the edge of, but outside, the reserved forest. The trees had come up and had formed a small plantation. He applied for the land, and the order was that as the applicant planted the trees, rent should not be charged to him if he obtained a grant of the land, but that he would be at liberty to cut down or keep the trees, provided he paid the usual rate of revenue.

In this manner it is by no means impossible that considerable areas of teak forest near the reserves may pass into private hands, and this will, under existing circumstances, render the protection of the forests exceedingly difficult. It will facilitate the cutting of teak on Government land, which will be exported as having been cut on private lands. The matter is obviously of very great importance, and the only safeguard will be to include all teak-producing forest, as far as practicable, within reserved or village forests.

**How to be protected.**

82. The area of teak-producing forest in British Burma is exceedingly limited, and if it is intended that the Government forests of the province shall eventually contribute a considerable share of the teak timber required for local consumption and export trade, no large extent of valuable teak forest must be excluded from reserved or village forests. It is certainly necessary that the villages on the outskirts of the forest should, apart from any rights they may possess, have every facility given them for providing themselves with forest produce. And this may be accomplished, with due regard to the maintenance and improvement of the teak-producing forest, by including such areas either in reserved or in village forests. If included within reserved forests, rights would be granted to the people within defined tracts, which would be demarcated in the same manner as the areas assigned to the Karens for toungya cultivation. Such rights to cut bamboos and timber (not teak), to collect other forest produce, and to pasture cattle, would not, unless exercised in an excessive manner, damage the forests; on the contrary, the cutting of bamboos and timber would give more room to teak, the growth of which in most cases would benefit thereby. And arrangements might even be made to protect such areas against fire.

**Village forests.**

83. The conditions under which such areas might be formed into village forests would be similar, except that there would be no recorded rights. The inhabitants of certain villages would have the free use of the forest, except that teak and other reserved trees would remain the property of Government. This last point should be distinctly understood, and it will be well to provide for it in the Forest Act. The Government assigns certain areas of its own land to villages for the use of their inhabitants, and has a perfect right to impose such conditions as may be expedient. It is possible in Burma to combine the good management of a teak-producing forest with the free user of bamboos and other woods growing in that forest, provided such user is not excessive. These favourable circumstances should be utilized, in order to make the needful extent of forest available for the use of the people without diminishing the area required for the production of teak. These objects, however, can only be attained if clearings for toungya cultivation are strictly prohibited in such areas. It will be borne in mind that the forest tracts which contain teak are exceedingly limited, and that outside the teak forests there is in most districts an enormous extent of forest without teak, which is available both for toungya clearings and for the extension of permanent cultivation.

**Karen areas.**

84. The arrangement here suggested, in regard to the teak-producing tracts situated near the outer edge of the forest belt, is analogous to the arrangement under which areas, generally in the heart of the forest, are assigned to the Karens for toungya cultivation. But there is this essential difference, that these lands have been specifically assigned to the Karens to enable them to carry on their toungya clearings.

The system of limiting the Karens to certain defined areas, wherein to cut their toungyas, was first suggested by Major Scaton in 1873, and it was first actually carried out in demarcating the Thoonzai forests in 1876. Since then the practice has been followed in the case of all reserves demarcated on the western slopes of the Pegu Yoma in the Tharawaddy and Prome Districts, where the presence of Karen settlements required that such areas should be assigned to them.

**Conditions under which assigned.**

85. These Karen areas are not excluded from the reserved forests, but certain important relaxations from the rules enforced in the reserved forests have been made in regard to them. The Karens residing in these areas are permitted to supply themselves with timber (except teak), with bamboos, and all other forest produce for their own domestic or agricultural requirements. They may cut toungyas and may burn them, provided they take the necessary precautions against fire spreading into the forest. As regards teak in toungyas, the only restriction is that they must not cut or injure any teak tree above 18 inches in girth. There is some difference in the wording of the conditions under which such areas have been assigned in the different forest districts, but the above represents the general purport of the arrangements made.

In cases where permanent paddy fields or plantations of betel-vines are included within the Karen areas, these may be cultivated as heretofore, and extensions may be made. Rights to betel-vine gardens, situated outside the Karen areas, but in the reserve, have also been recognized where they were found to exist.

**To whom assigned.**

86. These areas are not assigned to any particular Tsokay, or head of the clan, but to the entire Karen community. Outsiders, who do not belong to that community, are not allowed to settle in the area. The protection afforded by this provision against the immigration of persons who might otherwise come up from the plains to cut toungyas in these lands, is regarded as a great boon by the Karens. There seems, however, to be no objection to the inclusion within Karen areas of any Burmans or Yabins who may be old settlers within the tract. In such cases due precautions must be taken to assign the rights in question to certain persons by name and to their descendants, and to give the forest officer some control in the matter, so as to enable him to prevent immigration from elsewhere. Otherwise, the grant might be used to introduce a large number of outsiders, which it is intended to guard against; the sole object in setting apart these tracts being to provide the people already settled in the hills with the means of carrying on their toungya clearings in the districts hitherto occupied by them.

**Results expected.**

87. It has often been maintained, and I have heard it stated repeatedly on my late tour, that the practice of toungya cutting has not done much harm; that the Karens confine their clearings to the bamboo forest in which toungyas have been cut for generations; and that the teak forest is attacked only in exceptional cases, when their ordinary toungya grounds fail on account of the flowering of the bamboos or some other circumstance. This view of the case, however, holds good only in those tracts where the rules against cutting toungyas in teak forests have actually

been enforced since they were originally made in 1856, and where consequently teak has not suffered from toungya cultivation. But such tracts are few and limited in extent. The wholesale destruction of the teak forest in the greater part of the Thayetmyo District, on both sides of the Irawaddy River, on the hills south of the Thouk-yay-gat River, in the Upper Salween forests, and in many other places, shows the destructive effect of unrestricted toungya clearings upon the teak in the forest; and the plan now followed in Pegu of defining this destructive mode of cultivation within fixed limits is excellent, and will doubtless have a most beneficial effect.

88. Karens, however, are arbitrary and somewhat fanciful in their proceedings; and the experience of the system has not yet been sufficiently long to justify the prediction that the Karens will abide by the boundaries defined for them. This will probably be the chief difficulty in the matter. Under existing arrangements, the Karens have not been granted the right to trade in the forest produce which they are permitted to cut or collect for their own requirements. In many cases, however, it will probably be found possible to grant to the Karens permission to sell bamboos, shaw fibre, and other produce collected within the areas assigned to them; but this permission should in all cases be specifically granted by the forest officer to persons by name, during good behaviour, and for a limited period.

**Permanent cultivation should be encouraged.**

89. Wherever suitable land for wet paddy cultivation is available in any tracts assigned to the Karens, or elsewhere in the reserve, it should be the aim of the forest officers to induce the Karens to occupy such areas and to settle down to permanent cultivation, thereby setting free, and making available for the production of teak, portions of the toungya grounds now occupied by them. In most cases it is want of cattle that prevents toungya cutters from settling down permanently, and this is an obstacle which the forest officer might do much to help the Karens to overcome, by employing them in the forests and by giving them opportunities for earning money.

From the detailed account of the tracts already allotted to the Karens in the reserves, which is given further on in this report, it will be seen that in all cases the areas assigned to them are much in excess of what may be estimated as their actual requirements for the purpose of toungya cultivation. In making this estimate, the average area cleared annually by each toungya cutter has been assumed to be three acres. But this area varies exceedingly. It chiefly depends upon the extent of land which the members of a family can manage to weed during the rains, for weeding is the chief work in toungya cultivation. In some districts the average area for each toungya cutter is probably as high as four acres. The time which it takes for the forest to grow up, so as to be fit again for toungya cultivation, likewise varies exceedingly. Bamboo forest, it is generally supposed, can be cut every five to seven years. This, however, is a much shorter period than is usual with the Karens of the Pegu Yoma. Tree forest is said to require from 15 to 20 years, but toungyas are generally cut in tree forest of a much older age. It must also be borne in mind that there are large areas in the forests which are considered as quite unfit for toungya cultivation by the Karens. Hence the areas assigned to them under these arrangements must necessarily be very extensive.

## CHAPTER IV.

### PROGRESS MADE IN DEMARCATION.

90. The following is a brief account of the reserved forests already demarcated in the Pegu Circle and of the work that still remains to be accomplished in this respect.

#### Forests in the Irawaddy Valley.

The principal forests demarcated are situated on the west side of the Pegu Yoma range. Here a continuous belt of forest has now been demarcated, extending from north to south over a length of 110 miles, from the northern frontier to the Thoonzai forest. They are situated in the Thayetmyo, Prome, and Tharawaddy districts. The work of demarcation commenced in 1870, and was completed in 1879. The Nawing forests, aggregating 148 square miles (105 square miles without the Karen areas), though included in this belt, have not yet been finally sanctioned by the Chief Commissioner.

These forests form a long belt of irregular shape, and are bounded on the east side by the main ridge of the Pegu Yoma. In places the belt is narrow, and comprises only the inner or eastern portion of the hills; while in others it extends to the foot of the hills. A few outlying blocks are situated in the plains and on low hills near the river. These it will be convenient to notice separately.

#### Reserves in the Plains.

91. The reserves situated between the hills and the river are all in the Prome and Tharawaddy districts; none in Thayetmyo. Proceeding from north to south, they are as follows:

*In the Prome District—*

(1) *Htonyea:* a piece of eng forest, measuring 12,224 acres, and situated north-east of Prome, on both sides of the Prome and Meaday road.

(2) *Prome Teak Plantation:* on the banks of the river, with an area of 73 acres, a full account of which will be found further on in Chapter X. of this Report.

(3) *Simmesway:* east of the Simmesway railway station; eng forest, measuring 6,400 acres.

(4) *Pouktau:* eng forest, south-east of the last and further inland, measuring 4,672 acres.

(5) *Shway-Kyoondau:* south of Engma; area 256 acres. This is a remarkable forest of almost pure teak. It is situated in the plains, and is surrounded by cultivation on all sides. It was protected from devastation, not by any local difficulties hindering the export of its timber, but by the superstitions of the inhabitants. The following account of this forest was given in the Report for 1861-62:

The nats or demons which are supposed to inhabit the trees of this forest are so much feared that a Burman does not even venture to touch a leaf, much less to fell or girdle a tree. And while the superstitious fear of the nats has preserved the teak in this forest, the neighbourhood of several large villages, by removing for firewood almost all trees of other kinds, has left the Royal Forest a singular instance of an almost pure teak forest in this country.

A heavy cyclone in April 1860 blew down a large proportion of the first class trees. The headmen of a village of Burmese Christians, residing in the neighbourhood, offered to cut up these trees and to take them to Rangoon. A contract was concluded, and, in 1861-62, 199 pieces, measuring 138 tons, were brought down. This has been the first yield of timber from this forest. A larger quantity is expected in 1862-63: 385 trees were girdled; this is about one-third of the first class trees. A much larger proportion even can safely be

girdled in this forest, because, as noted above, it consists almost exclusively of teak and the number of second class trees is very large.

In February 1880 the forest was examined by Mr. Pickard, Assistant Conservator of Forests. He counted the trees on three sample plots, aggregating 1·20 acres, and obtained the following result:

| | On 1·20 acres. | Per acre. | On 225 acres |
|---|---|---|---|
| | Trees. | Trees. | Trees |
| First class, above 6 feet ... ... | 4 | 3 | 675 |
| Second ditto 4′ 6″ to 6′ .. ... | 19 | 16 | 3,600 |
| Third ditto 1′ 6″ to 4′ 6″ ... | 75 | 62 | 13,950 |
| TOTAL ... | 98 | 81 | 18,225 |

Mr. Pickard estimates the area stocked, exclusive of blanks, at 225 acres.

A valuation of this forest was made in February 1862, and is recorded in the Report for 1861-62, but it is doubtful whether the survey can be depended upon, and no comparison, therefore, can be made. In 1862, 385 trees were girdled, and the quantity of timber exported from the forest during the last 23 years has been 1,186 tons. A few of the old girdled trees are still standing. The whole of the marketable trees of the first class might be girdled without injury to the forest. But if this is done, the forest should be protected against fire, so as to promote the growth of seedlings.

*In the Tharawaddy District—*

(6) *Choungzouk:* mixed forest, with cutch; situated south-east of Poungday, on both sides of the railway; measuring 3,700 acres.

(7) *Thitcho:* teak and mixed forest, north of the Minboo choung; measuring 1,400 acres.

(8) *Kangyee:* area 3,800 acres; partly teak, partly mixed forest, on high ground between the Minboo and Boben choungs. This and the Thitcho forest will again be noticed further on.

(9) *Choungnagoon:* on the railway, south of Konityoua; set apart to supply fuel for the railway; area 300 acres.

(10) *Toukkyan:* area 4,640 acres; on the north bank of the Gamoong; teak, eng, and mixed forest.

(11) *Thakolan:* area 960 acres; on the south bank of the Gamoong; teak and mixed forest.

(12) *Hsatpoke:* fuel reserve, near the railway; mixed and teak forest, also cutch; area 4,700 acres.

(13) *Tsitquin:* area 2,700 acres; on the railway, between Minhla and Leppadan; mixed forest.

(14) *Thendawyo:* north-east of Thoonzai; area 6,400 acres; mixed forest.

In addition to these, a small corner of the Minhla reserve extends into level ground; but the area is small and not worth mentioning.

That portion of the Tharawaddy and Prome districts which is situated between the hills and the Irawaddy river measures not less than one million acres, and the blocks taken up as forest in this part of the country aggregate 52,225 acres (or 82 square miles), which is little more than five per cent. of the total area. It is probable that additions will have to be made on the dry hills of the Thayetmyo district, in the place of two old reserves—Thabyelah and Bangong—which it has been decided to give up; and, in order to ensure a permanent supply of fuel near the river, a reserve will probably have to be formed on the high ground near Taropmaw, south of Shwaydoung.

### Reserves in the Hills.

92. On the hills of the Thayet, Prome, and Tharawaddy districts, east of the Irawaddy, the area of the demarcated reserves aggregates 1,157 square miles, including 213 square miles assigned to the Karens for toungya cultivation. The following is a brief account of these forests.

### Choungoungyee and Boolay Forests.

Estimated area, 125 square miles along the Yoma, and two outlying blocks—Teindaw and Tsatsowa—12 square miles; total 137 square miles. This reserve extends from the northern frontier to the head waters of the North Nawing, over a length of 22 miles, with an average width of 5½ miles. In demarcating this reserve a large area of hilly country was left out on the west side, to give room to a small number of Karen villages for toungya cultivation. The forest included within the reserve is of exceedingly varying character; extensive areas of old toungya clearings, where the teak has disappeared, alternating with ridges and spurs untouched by toungya clearings and stocked with promising teak forest. In the Burmese time these forests, especially those near the frontier, yielded large quantities of long and thick planks, called *Shinbyins*—split, not sawn—which were highly valued and fetched large prices. They were dragged by bullocks and buffaloes, no elephants being used here for timber work in those days. The forests contain mostly underwood of Myin-wa (*Dendrocalamus strictus*), and are dry and leafless during the hot season. Near the Yoma they are moister, with Kyathoung-wa (*Bambusa polymorpha*), and the growth of the teak is better. Of other trees, Cutch (*Acacia Catechu*) is the most common, and formerly there was a considerable proportion of Kokoh (*Albizzia Lebbek*) and Padouk (*Pterocarpus indicus*); but these trees are said to be very scarce at present. It is stated in the Forest Report for 1859-60 (paragraph 18) that the wood of these trees, which was used largely for cart-wheels, paid duty to Government during the Burmese time.

The following is an extract from the Pegu Forest Report for 1860-61:

The Pudday stream is the south branch of the Boolay river. In the dry season it has water in pools only. Teak has been very much worked out here under the Burmese rule; the trees were generally split into large planks, and were then carted to the lower part of the river, where floating in the rains is practicable. Cart-roads in the Pudday forests go far to the east into the heart of the hills.

The Choungoungyee and its tributaries drain a considerable area (600 square miles), part of which is beyond the British frontier. Several of its feeders have running water throughout the year. Teak of excellent growth is found close to the bank of the streams, but is not very plentiful. On the hills, however, which stretch from the central Yoma range to within 20 miles of the Irawaddy river, are teak localities of considerable extent, and estimated to contain about 1,000 full-sized trees on the square mile. A portion of these hills south of the Choungoungyee stream is inhabited.

The villages are Karen, Burmese, and Chin; the last-named mostly employed in the manufacture of cutch. All have extensive toungya clearings. Large numbers of teak trees destroyed by the toungya fires or girdled by the cultivators, and stumps with fresh shoots, showing them to be the remains of trees felled green, were found. Here the Forest Rules have had but little effect in checking the destruction of teak trees by toungya cultivation.

The Choungoungyee forests abound in large specimens of the Kokoh—a species of *Albizzia*—and Padouk (*Pterocarpus*). Specimens of the former were measured 15 feet in girth, and with a clear stem from 80 to 100 feet high; the wood is dark red, and much prized for cart-wheels and boats.

93. During British rule, since 1856, the forests in the valleys of the Boolay and Choungoungyee rivers have yielded 16,498 tons of teak timber, and during the same period 5,425 trees were girdled. The large excess of timber extracted over girdled trees is explained by the large quantities of seasoned timber remaining in these forests at the time of annexation. These figures, however, relate not to the restricted area demarcated as a reserved forest, but to the total area of the forests on these rivers.

The yield of the demarcated reserve has for the present been assessed at 400 trees annually; that is, until a complete examination of the forest has been made and a regular plan framed, not more than 400 mature trees should be girdled in any one year.

**Nawing and Choungzouk Forests.**

94. These comprise a portion of the forests on the hills which are drained by the feeders of the Nawing choung, including the North Nawing, Tsoon-choung, Choungzouk, Middle Nawing, and South Nawing. The demarcation of a portion of these forests has not yet been sanctioned; they are, however, included here, as it seems probable that they will be sanctioned, in order to complete the series of the forests on the western slope of the Pegu Yoma range. The total area, including those not yet sanctioned, is 247 square miles, including 43 square miles occupied by Karens. The length from north to south is about 25 miles; but the width is very irregular, being only three or four miles at the southern end and 22 miles in the centre, north-east of Prome, where the outer hills on the Choungzouk river are included. In order to enable the Karens who inhabit these forests to cut toungyas, three tracts, aggregating 43 square miles in area, have been demarcated inside the reserve for the use of the Karens.* Here, if the reserve is sanctioned, they will have liberty to cut their toungyas without restriction, except that they will not be permitted to cut any teak trees above 18 inches in girth. Like the Choun-goungyee and Boolay forests, those on the feeders of the Nawing are extremely dry, chiefly containing myin-wa mixed with kyathoung-wa on the higher ridges. Of other trees, cutch is the most important associate of teak.

95. Since 1856, 31,846 trees have been girdled in the Nawing forests, which, however, were much more extensive at that time than the limited area now proposed for demarcation; and 21,048 tons of timber were exported. From 1862 to 1874 the forests were worked by permit-holders, who exported the timber on their own account, and who did not find it pay to work out the whole of the girdled timber, but limited their operations to the best logs. Much timber thus remained in the forests, of which a large proportion was destroyed by the annual fires. But it is doubtful whether this is sufficient to explain the great difference between the number of trees reported to have been girdled and the timber exported; and it is probable that a portion of the trees reported to have been girdled in the earlier years, when the Conservator worked single-handed without assistants, and the work had therefore to be done without sufficient supervision, were not girdled at all. The mean annual yield of the Nawing forests, inside and outside the reserves, has been 915 tons, and the yield of the area proposed to be included in the demarcated reserve has for the present been assessed at 600 trees a year. This yield, however, cannot be attained unless the whole area proposed is included within the demarcated reserve.

**Shwaylay and Shaboung Forests.**

96. Area 99 square miles, including 12 square miles demarcated for the use of the Karens. This Karen area is occupied by two Karen tays, inhabited by 40 families. The total population is 136 souls, and there are 40 toungya cutters, who cut annually an area of about 120 acres. In the dry climate of the Shwaylay the length of rotation is probably 30 years: hence these people would require an area of 3,600 acres, or $5\frac{1}{2}$ square miles, for their requirements. The area assigned to them is 12 square miles. It must, however, be borne in mind that the whole area assigned to them is not fit for toungya cutting, and that a margin must be left for increase of population.

The Shwaylay stream does not rise in the Yoma, but its head-waters are separated from those of the Nawing and Toungnyo by a high ridge running north and south about three or four miles west of, and parallel with, the Yoma range. This forest consists of a large block at the head-waters of the Shwaylay, and of two narrow belts which project into the outer hills, enclosing the valley of the Shwaylay choung. The southernmost and larger of these projecting belts comprises the Shaboung and Bwet forests, as well as the adjoining forests (Padinbon and upper and lower Tapan) which form part of the Toungnyo reserve. The greater part of the Shwaylay forest is exceedingly dry, the

* There are five Karen tays, inhabited by 74 families; and there are 71 toungya cutters, who cut annually an area of about 213 acres. Under a rotation of 30 years, these people would need an area of 6,390 acres, or 10 square miles. The area proposed to be assigned to them is 43 square miles.

bamboo on the hills being chiefly myin-wa, which is leafless in the hot season; while Thaik-wa (*Bambusa Tulda*) is found on stretches of diluvial soil in the valleys. With few exceptions, the soil is a stiff loam, generally with numerous deep cracks after the rains. A large proportion, and in some places the majority, of the full-sized trees are hollow, and the growth is very slow. Of other trees, cutch is the most common, both large and small trees being abundant. Until 1860, no large timber was exported from this forest, the lower part of the course of the Shwaylay stream being obstructed in the plains. Until then the chief mode of utilizing the timber consisted in cutting up the logs in the forest into large plates, trays, and dishes (okes, biahs, and dounglans). The remains of this old industry are still found in the forest, and it is for consideration whether in future some of the larger trees in the less accessible portions of this and the neighbouring forests may not under proper precautions be utilized in the same manner. In March 1860 a canal was dug to open out the Shwaylay stream, and all the timber since exported has been floated through this canal. This forest should be worked on a short rotation, and the growth of large girth timber should not be contemplated. In no forest perhaps will fire-protection prove to be so beneficial as in the Shwaylay forest. The Bwet choung block, which forms the south-western-most corner, has now been protected during the last three years; and as soon as funds and establishments are available, the protection of the remaining Shwaylay forest should be taken in hand; and after the ground has thereby covered itself with young growth of teak, the whole of the first class trees that are marketable should be cut out.

97. No timber was exported from the Shwaylay forests between 1856-57 and 1859-60. Since the opening of the canal they have yielded 29,713 tons of timber, while 29,804 trees were girdled in them. But this refers to the forest outside the reserves, as well as to that included within the demarcated area. The annual yield of the demarcated reserves has for the present been fixed at 700 tons. But as soon as fire-protection is firmly established in the Bwet and Shaboung forests, it will, as explained, be advisable to make heavy cuttings in these blocks.

**Toungnyo Forest.**

98. This forest comprises the hills which enclose the valley of the Toungnyo stream, which has its head-waters close to the Pegu Yoma. For the Karens several blocks have been demarcated inside the reserve, aggregating 36 square miles. This area is occupied by seven Karen tays, inhabited by 86 families. The total population is 446 souls, and there are 90 toungya cutters, who cut annually an area of about 270 acres. Under a rotation of 25 years, these people would require an area of 6,750 acres, or 10 square miles, for their requirements. The area assigned to them is 36 square miles. Including this, the total area is 166 square miles. As regards the character of this forest, it may be said that the outer hills are dry and the soil a stiff loam, similar to the soil in the Shwaylay and Shaboung forests. Here myin-wa is the common bamboo. Kyathoung-wa and here and there Wa-ya (*Dendrocalamus longispathus*) and Tin-wa (*Cephalostachyum pergracile*) are only found on and near the higher ranges. Cutch is common, and is particularly abundant on deserted toungya clearings. The hills north of the Toungnyo stream, known as the Padinben and Tapan forests, are clothed with an abundance of teak. But of these forests a large area in the vicinity of the villages has been excluded from the reserve. Higher up the valley, north of Thamadee, the forest included in the reserve is very poor and dry, containing very little teak. South of the Toungnyo stream are several very valuable blocks, of which the Nyanlay is the most important. The north part of this forest is occupied by a high ridge, stocked with kyathoung-wa and excellent teak; while the southern part consists of old toungya clearings and scattered patches of teak forest. The head-waters of the Toungnyo stream contain a good deal of mixed forest on the higher ridges, where teak is associated with Pyinkado (*Xylia dolabriformis*), Yoongben (*Anogeissus acuminata*), and Myoukshaw (*Homalium tomentosum*). Here are some exceedingly valuable teak-producing tracts, which, being difficult

of access, have not been much worked. A large area of teak-producing forest, skirting the reserve in the Toungnyo valley, has been excluded. It is estimated to contain 9,000 full-sized trees, but this estimate is probably far below the mark.

99. The outturn of timber from the Toungnyo forest since 1856 has been 21,803 tons (mean annual yield 948 tons), while 18,807 trees were girdled. Demarcation has excluded a large area of good teak forest, and the annual yield of the remaining area has provisionally been fixed at 900 trees. After fire-protection has been firmly established in the outer blocks, which to a great extent consist of dry myin-wa forest, particularly in Padinben, Tapan, Pazingyay, and Nyanlay, and after the cultural operations now in progress have farther advanced, heavy fellings may and should be made. These outer dry forests should, like Shwaylay and Shaboung, be worked on a short rotation, the timber having a tendency to grow hollow when old.

**Minboo, Kangyee, and Boben Forests.**

100. These forests comprise the hills on the head-waters of the Minboo and Boben streams and two outlying blocks in the plains—the Thitcho and Kangyee. The Minboo is a small stream which does not rise in the main Yoma range, but is separated on the east from the basin of the Boben stream by a high ridge, called the Kolin-kyo. There are no Karens in the Minboo forest, but in the Boben two large blocks, aggregating 25 square miles, have been set apart in the heart of the forest for the Karens. This area is inhabited by 47 families, and the total population is 161 souls, of whom 47 are toungya cutters, who cut annually an area of about 141 acres. Under a rotation of 25 years, these people would require an area of 3,525 acres, or 5 square miles, for their requirements. The area assigned to them is 25 square miles. Including the Karen area, the total area of the reserve is estimated at 136 square miles.

101. Twenty years ago the Boben forest was one of the richest in Pegu as regards teak. In paragraph 6 of my Report for 1859-60, it is recorded that on the 17th and 18th April 1858 I counted 1,092 trees, 6 feet and above in girth, on 236 acres near the Yanchoung, one of the chief tributaries of the Boben. But the greater part of these very rich teak localities on the Upper Boben have since 1858 been cut up by toungyas, and they are now included in the Karen areas. The forest between the Karen areas and the Yoma is not worth much, so that the most valuable portion which remains to Government is the forest west of the Karen area. The character of this part of the forest varies. Some of it is dry, with myin-wa, and there is some eng forest, with a large proportion of Engyin (*Pentacme siamensis*); but fortunately a large area is moist, with good light loam, and stocked with a large number of teak trees of the smaller classes. But on the outer hills, north-east of Boben Sakangyee village, a considerable extent of good forest, with numerous large trees, has been excluded from the reserve.

102. The yield of these forests (including those outside the area as at present demarcated) during the last 23 years has been 39,243 tons, or on an average 1,706 tons per annum. The number of trees girdled during the same period was only 26,874. The waterways in these forests are good, and they have always been efficiently worked by Government contractors; hence the large excess of the outturn over the trees girdled. It is estimated that in the area now demarcated 800 mature trees may be girdled annually without detriment to the forests.

**Tounchoung, Gamoong, and Minhla Forests.**

103. These forests comprise the hills on the head-waters of the Tounchoung, the Gamoong, Kadet, Ngapiin, and Myoung choungs (the last three are all feeders of the Gamoong), and of the Minhla; and also include two small outlying blocks on the Gamoong choung in the plains, the Toukkyan and Thakolan forests, which have already been mentioned. Of these streams only the Toun, Gamoong, and Minhla come from the main Yoma range, and near their sources some valuable teak localities are left. The other streams

are shorter. 30,250 trees have been girdled in these forests during the last 23 years, and the timber exported during the same period has amounted to 51,919 tons, or 2,257 tons per annum. The excess in the timber exported is due to the large quantity of dry timber left in the forest in 1856, owing to the disturbed state of this part of the country after the war, and to the fact that this, like the other Tharawaddy forests, was always worked efficiently by contractors on Government account. The yield of the demarcated area has been provisionally fixed at 800 trees annually.

The demarcated area is estimated to measure 110 square miles, of which 47 square miles have been assigned to the Karens in two large blocks—one on the Toun and Gamoong choungs, the other extending from the Kadet to the Minhla choung. This area is occupied by eleven Karen tays, inhabited by 116 families. The total population is 540 souls, and there are 116 toungya cutters, who cut annually an area of about 438 acres. Under a rotation of 25 years, therefore, these people would require an area of 10,950 acres, or 17 square miles, for their requirements. The area assigned to them, as already mentioned, is 47 square miles, and it includes some of the best teak localities in Pegu. On the Gamoong choung the Karens have some permanent paddy cultivation, and all over the areas assigned to them they have plantations of betel vines, the vines twining round trees of *Erythrina* (generally *E. li'hosperma*, Miquel). Good forest has, however, also been left in the area not assigned to Karens. The outer edge of the reserve and some of the tracts excluded near the western boundary are particularly rich in teak timber of the smaller classes, between 18 inches and 6 feet in girth. Of bamboos, kyathoung-wa and tin-wa are plentiful. Myin-wa is limited to dry ridges, particularly near the Yoma range, and is less common here than in the drier and more northern forests.

**Mokka and Boeling Forests.**

104. This reserve comprises the hills on the Mokka and the two branches of the Beeling river, the Kadin and Koon Beeling. The Kadin Beeling takes its rise in the main Yoma range, the Mokka and Koon Beeling are short streams. Since 1856, 31,514 trees have been girdled in these forests, and 44,378 tons of timber exported, the mean annual yield having been 1,929 tons. But these figures relate to a much larger area of forest than is included in the present reserve. The area now demarcated is 162 square miles, which includes 30 square miles assigned to the Karens in two blocks—one on the Mokka, and the other on the Kadin Beeling. This area is occupied by ten Karen tays, inhabited by 122 families. The total population is 504 souls, and there are 122 toungya cutters, who cut annually an area of about 366 acres. Under a rotation of 25 years, therefore, these people would require an area of 9,150 acres, or 14 square miles, for their requirements. The area assigned to them is 30 square miles. The Karens have established themselves firmly in their areas, having permanent paddy land on the banks of the Kadin Beeling and plantations of betel vines. Outside the reserve boundary is a large extent of teak forest, at the back of the villages of Samboke, Kyaynee, Nyoungbenzin, Hnet-pyaw-dong and Shawdong. An area measuring 24,000 acres has here been brought under protection from fire, under the name of the Mokka Beeling Reserve. This is one of the finest forests in Tharawaddy; moist soil; the bamboos chiefly tin-wa and kyathoung-wa; a large number of first class, and an abundance of tall second and third class trees. Outside this block, teak is most abundant in the northern part of the Beeling Karen area, between the Beeling Myouk choung and the Kyouktaga. The hills included in the Karen area south of the Kyouktaga river are mostly deserted toungya clearings, with very little teak; so is also the range which forms the boundary between the Koon Beeling and the Hmyah choung, a feeder of the Kadin Beeling. The hills near the Kyekkelay toung are moist, with valuable forest; but along the foot of the main Yoma range there is a belt of very poor forest, with very little teak. The number of trees to be girdled annually within the demarcated area has provisionally been fixed at 1,000.

**Thoonzai Forest.**

105. Area, 50 square miles of reserve and 20 square miles for the use of the Karens; total 70 square miles. The Karen area is occupied by seven Karen tays, inhabited by 57 families. The total population is 213 souls, and there are 57 toungya cutters, who cut annually an area of about 171 acres. Under a rotation of 25 years, therefore, these people would require an area of 4,275 acres, or 6⅔ square miles, for their requirements. The area assigned to them is 20 square miles.

106. These forests, though not very extensive, have contained, and probably still contain, some very valuable teak localities. The abstract of the valuation surveys made in these forests between 1858 and 1863, recorded in Statement I. appended to the Report on the Working Plan of 1868, gives the following figures:

| | | | | | | |
|---|---|---|---|---|---|---|
| First class teak trees, counted on | 1,020 acres | ... | 2,102, | or, per acre | ... | 1·14 |
| Second | ditto | ditto | ... 1,065 | ditto | ... | 1·04 |
| Third | ditto | ditto | ... 2,473 | ditto | ... | 1·28 |
| | | | Total of the first three classes | | ... | 3·46 |

And some of the surveys gave as many as five first class trees per acre. Teak in the Thoonzai forests has generally tall, clean, and regularly-shaped stems. The soil is favourable for the growth of the tree, being a light sandy loam, resting on grey sandstone and calcareous shales. The bamboos are mostly kyathoung-wa and tin-wa, with thaik-wa on diluvial soil in valleys.

107. Since 1856 these forests have yielded 10,013 tons of timber. The total number of trees reported to have been girdled during the same period was 22,994. The Thoonzai forest was worked by contractors on account of Government from 1856 to 1861. In 1861 it was made over to permit-holders, who brought out the timber on their own account during a period of six years, from 1862 to 1867. From 1868 the forest was again worked by Government contractors. The small outturn, as compared with the large quantity of trees reported to have been girdled, has been explained by the fact that the forests were worked for six years by permit-holders, whose interest it was to bring out the very best timber only. This explanation, however, is insufficient. It is probable that here, as in the Nawing forests, the whole of the timber reported to have been girdled in the earlier years was not girdled at all. In those years the superior staff was small, the Conservator of Pegu was almost single-handed, and the work of girdling could not be efficiently supervised. A similar excess of the trees girdled over the timber exported is noticed in some forests which immediately adjoin the Thoonzai, viz., the Oakkan, Magayee, and Maizalee. A glance at Statement II., appended to this Report, will show that these forests, together with Thoonzai and Nawing, are quite exceptional in showing an excess of the trees reported to have been girdled over the timber exported. It is probable that in these forests a much less number of trees was actually girdled than was reported.

108. Unfortunately, no late valuation surveys are available, showing the present condition of the Thoonzai forest. But so much is certain, that the number of trees of the second and third classes has increased very largely. These smaller classes are particularly abundant near the southern edge of the reserve. The road from Way village to Tohdee tay leads through forests of tall and well-shaped teak poles, and extensive tracts of similar forest have been excluded from the reserve east of the Thoonzai stream and south of Way village. The area assigned to Karens in this forest is situated east of the river; it consists mostly of old toungya clearings, with no large extent of valuable forest. A Karen settlement (Tohdee tay) is outside the area, and its toungyas are on both sides of the watershed which divides the feeders of the Koon Beeling and Thoonzai rivers. But the inhabitants of this tay are all employed in planting teak in the toungyas cut by them.

Until more is known regarding the present condition of the Thoonzai forests, they must be worked sparingly, and I suggest, therefore, that not more than 300 trees be girdled annually.

**Summary.**

109. The following statement is an abstract of the area, outturn, and proposed annual yield of the demarcated reserves situated on the west slopes of the Pegu Yoma, between the frontier and the Thoonzai forest. It will be remembered that this statement includes the Nawing forests, though they have not yet been finally sanctioned:

| Demarcated Reserves. | Civil District. | Estimated area, in square miles. | | | Proposed maximum annual yield, 1880-81 to 1884-85. | Mean annual yield of Forests, including area outside Reserves during the 23 years, from 1856-57 to 1878-79. | |
|---|---|---|---|---|---|---|---|
| | | Forest. | Karen area. | Total Reserve. | | Trees girdled. | Timber exported (tons). |
| | | | | | Trees. | | |
| 1. Boolay and Choungoungyee ... | Thayetmyo... | 137 | ... | 137 | 400 | 236 | 717 |
| 2. Nawing and Choungzouk ... | Promo ... | 204 | 43 | 217 | 600 | 1,384 | 915 |
| 3. Shwaylay and Shaboung ... | | 87 | 12 | 99 | 700 | 1,296 | 1,292 |
| 4. Toungnyo ... | Tharawaddy | 130 | 36 | 166 | 900 | 817 | 948 |
| 5. Minboo, Kangyee, and Boben ... | | 111 | 25 | 136 | 800 | 1,168 | 1,706 |
| 6. Tounchoung, Gamoong, and Minhla | | 93 | 47 | 140 | 800 | 1,315 | 2,257 |
| 7. Mokka and Beeling | | 132 | 30 | 162 | 1,000 | 1,370 | 1,929 |
| 8. Thoonzai .. | | 50 | 20 | 70 | 300 | 999 | 435 |
| Total ... | | 944 | 213 | 1,157 | 5,500 | 8,585 | 10,199 |

Note.—Trees provided to be girdled, by working plan of 1868, during five years, from 1869 to 1873—

| | | | | |
|---|---|---|---|---|
| (1) Prome East ... ... ... | 6,000, | or | 1,200 | per annum. |
| (2) Tharawaddy ... ... ... | 20,000, | or | 4,000 | ditto. |
| (3) Thoonzai ... ... ... | 4,000, | or | 800 | ditto. |
| Total ... | 30,000, | or | 6,000 | ditto. |

110. The annual yield proposed to be fixed for the next five years is considerably less than the actual average yield of the last 23 years, and less than the yield fixed by the working plan framed in 1868 for the five years from 1869 to 1873.

In forests which, like those of Pegu, must be worked by means of selection fellings, the annual yield must be expressed in "trees"; and as in Burma the operation controlled by the Department is not that of felling, but of girdling, the annual yield of a forest must be expressed by the number of trees that may be girdled annually.

111. Statement II. gives 197,899* as the total number of trees girdled between 1856 and 1879 in the Eastern Prome and Tharawaddy forests. But, as explained above, there is reason to believe that the reports of the earlier girdling operations in several forest districts, viz., the Nawing, Thoonzai, Oakkan, Magayee, and Maizalee forests, were exaggerated, and that in reality a smaller number had been girdled. The trees reported to have been girdled in these forests between 1856 and 1867 were 69,020. One-half of this number

* This includes 385 trees girdled in the Royal Forest (Prome), not entered in the statement in the preceding paragraph.

probably were never girdled. Making this deduction, the average number girdled annually is reduced from 8,600 to 7,000 trees, and this corresponds with the timber actually exported; for 7,000 trees would under careful management yield about 10,500 tons of timber. In this calculation it has been assumed that the dry timber standing and cut, which was in the forests in 1856, and which furnished the yield of the first four years, from 1856-57 to 1859-60, amounting to 17,653 tons, was equal to the dry timber standing and lying in the forests in 1879 *plus* the trees and timber destroyed since 1856 by the annual fires. This, however, is a mere assumption, which may or may not be correct.

112. The results stand as follows :

| Years | Mean annual number of trees girdled. |
|---|---|
| 1856-57 to 1878-79 ... ... | ... 7,000—actuals. |
| 1869 to 1873 ... ... | ... 6,000—proposals of working plan of 1868. |
| 1881 to 1885 ... ... | ... 5,500—present proposals. |

In comparing these figures it must be remembered that the present proposals relate to an area much smaller than the area of the forests which yielded the outturn of timber during the last 23 years and the area for which the plan of 1868 was framed. The selection of the trees to be girdled in these reserves will be a most important operation, to which the greatest attention must be devoted. This, however, will be more conveniently discussed in a subsequent chapter, which will deal with the working of the forests generally.

**Other Reserves in the Irawaddy Valley—Oakkan, Magayee.**

113. Having thus given an account of the demarcated reserves in the Tharawaddy district, as well as in those portions of the Prome and Thayetmyo districts which are situated east of the Irawaddy, it will be most convenient, first, to complete a review of what has been done and what remains to be done in the valley of the Irawaddy river, and afterwards to take up the valleys of the Pounglin and Pegu, Sitang and Salween rivers.

On the west face of the Pegu Yoma range the next forest south of the Thoonzai is the Oakkan. The demarcation of the forests on the headwaters of the Oakkan stream, measuring 125 square miles, including 13 square miles assigned to Karens, has lately been sanctioned.

South of the Oakkan the next streams are the Magayee and Maizalee. On both sides of the Magayee stream a reserve, measuring 20 square miles, has been demarcated, which contains 1,306 acres planted with teak between 1872 and 1878. A detailed account of this plantation will be found in the special part of this Report.

The timber extracted from the Oakkan, Magayee, and Maizalee forests since 1856 has been as follows :

| | Timber extracted. Tons. |
|---|---|
| Oakkan ... ... ... ... | ... 6,027 |
| Magayee ... ... ... | ... 2,659 |
| Maizalee ... ... ... ... | ... 535 |
| Total | ... 9,221 |

At the head of the Oakkan valley there are some excellent teak localities on the hills. In the Magayee and Maizalee the teak is scattered,

**Hline Yoma Reserve.**

114. Along the railway, between Oakkan and Ilmawbee, four reserves, aggregating 33 square miles, have been demarcated, with the view of furnishing fuel to the railway; and it has lately been decided to take up a portion of the forest between these reserves and the southern end

of the Pegu Yoma, so as to join on to the Magayee reserve in the north, leaving, however, a large area open along the lower course of the Maizalee stream, between the railway and Sakangyee, for the extension of cultivation. This reserve, which it has been proposed to call the Illine Yoma reserve, is estimated to comprise an area of 93 square miles; and when it is demarcated, the maintenance of a large forest area on the hills north of Rangoon will be secured, the produce of which can be brought to Rangoon by train, and the southern extremity of which will not be more than 35 miles distant from that city. The demarcation of this reserve has been sanctioned.

Rangoon, like Calcutta, to a great extent depends for its supply of firewood and small building wood upon the sundri and mangrove forests of the Delta; but the forests of the Irawaddy Delta are much less extensive than the Sundarbans. Bamboos and large timber are brought down the Irawaddy (chiefly from the Mindoon forests), the Illine, Pounglin, and Pegu rivers; but for firewood and charcoal the Illine Yoma reserve will eventually be of great importance. Teak is found scattered here and there throughout the forest, and eventually it will probably be found advisable to plant teak on toungyas or otherwise on a large scale in this area. Apart from the necessity of providing a reserve of charcoal and firewood for the town, the climatic effect of clearing away all forests in the vicinity of Rangoon might possibly prove of serious consequence.

South of the Hline Yoma reserve, at a distance of 26 miles from Rangoon, is the Kyetpyoogan teak plantation (683 acres), a detailed account of which will be found in the second part of this Report.

**Summary.**

115. The following is a summary of the forests demarcated (including the Nawing forests) between the Irawaddy river and the Pegu Yoma; Karen areas are excluded:

| | | Square miles. | |
|---|---|---|---|
| | | Sanctioned. | Proposed. |
| 1. | In the plains of the Prome and Tharawaddy districts ... | 82 | ... |
| 2. | In the hills of the Pegu Yoma, between the frontier and the Thoonzai forest ... ... ... | 839 | 105 |
| 3. | Oakkan ... ... ... ... | 112 | ... |
| 4. | Magayee ... ... ... ... | 20 | ... |
| 5. | Hline Yoma ... ... ... ... | 93 | ... |
| 6. | Fuel reserves in the Rangoon district and the Kyetpyoogan plantation ... ... ... | 34 | ... |
| | TOTAL ... | 1,180 | 105 |

This is a most satisfactory result, which reflects great credit upon the officers who have been engaged in this work. After the demarcation of the Nawing forests has been sanctioned, there will be on the east side of the Irawaddy valley 1,285 square miles of reserved forests, a large area of which contains teak. Of this area, about 150 square miles are in the plains, and the remainder in the hills of the Pegu Yoma, forming a continuous belt varying in width, 156 miles long, from the frontier to within 32 miles of Rangoon.

**Objections raised against the reserves.**

116. This forest belt, if properly managed, will be a source of great wealth to the province and will contribute much to the welfare of the agricultural population in the plains adjoining it. But this satisfactory result has not been attained without much opposition. Serious objections have been raised against the constitution as a reserved forest of a continuous belt, and these objections have chiefly been raised in regard to the following matters.

**Karen areas said to be insufficient.**

117. As regards the Karens who inhabit these forests, it has been urged that they have not sufficient room in the areas assigned to them; that these areas are hedged in by reserved forests, under the absolute control of forest

officers; and that the Karens will soon find their position untenable and will gradually evacuate them. To this the reply is, that the areas assigned to the Karens are many times larger than is required for their toungyà cultivation. They are not "small patches", as they have sometimes been called, but extensive tracts, which form a considerable portion of the reserved forests. The aggregate area of the reserved forests between the Nawing and Thoonzai forests is 807 square miles, and that of the tracts assigned to the Karens, 213 square miles. The detail is shown in the following statement, which is a summary of the data recorded in the preceding paragraphs:

*Areas assigned to the Karens in the different Forest Reserves.*

| Forest. | Number of families. | Area required. | Area assigned. |
|---|---|---|---|
| | | Acres. | Acres. |
| Nawing ... ... | 74 | 6,390 | 27,520 |
| Shwaylay and Shaboung .. | 40 | 3,600 | 7,680 |
| Toungnyo ... | 86 | 6,750 | 23,040 |
| Minboo, Kangyee, and Boben | 47 | 3,525 | 16,000 |
| Tounchoung, Gamoong, and Minhla | 146 | 10,950 | 30,080 |
| Mokka and Beeling .. | 122 | 9,150 | 19,200 |
| Thoonzai ... | 57 | 4,275 | 12,800 |
| TOTAL ... | 572 | 44,640 | 136,320 |

**Relations of Karens to Forest Officers.**

118. It has also been urged that very often the forest officer is the only representative of the British Government of whom the Karens have any personal knowledge; that forest officers do not deal with them gently and tenderly; that these people and their forefathers have from time immemorial inhabited the slopes of the Pegu Yoma range; that they are by nature essentially hillmen; and that if transplanted to the plains they will not be able to live.

The fact is, that the forest officers and the Karens are, as a rule, on the best of terms. Nor is this surprising, for the Karens are the only inhabitants of the forests, and the only people from whom the forest officer can obtain supplies, guides, labour for planting and timberwork, and assistance in case of emergency. Without the Karens the forest officer would be helpless, and it is his interest not to transplant them to the plains, but to keep them in the hills. Provided their toungya clearings are confined within limited areas, the presence of the Karens in the forest is a great advantage, and self-interest alone will always induce the forest officer to treat them with kindness and consideration.

It is, however, a great mistake to believe that the Karens of the Pegu Yoma could not live if transplanted to the plains. Every year Karen families leave the hills of their own free will and settle in the plains. They purchase cattle, open out permanent paddy-fields, build substantial houses, and instead of being unhappy they are proud of having advanced a step in civilization.

**Communications impeded.**

119. Another objection is, that there has hitherto been constant communication between the Karen settlements on each side of the Yoma, and that it is supposed that such communications will now be rendered difficult if the whole line of the watershed is in the hands of the Forest Department. It has been urged that a Karen on the western slopes of the Yoma hills cannot now visit his cousins on the eastern slopes without trespassing on a forest reserve. Nothing can be more erroneous than this view of the case. The reserved forests are not closed by fences or otherwise. They are open to the Karens now as they were formerly, the only change being that in blocks which are protected

against fire, precautions must be taken against the lighting and spreading of fires. But this is no hardship whatever. On the hills east of Toungoo, on both sides of the Thouk-ye-gat river, the Karens have protected the forests against fire from time immemorial over an area of several hundred square miles, and in these hills any persons who are careless with fire in the dry season have to pay severe penalties to the villages whose toungya grounds have been injured by conflagration.

As a matter of fact, the Karens in the reserved forests move freely to and fro, and the only change which has been made is, that toungyas can no longer be cut indiscriminately throughout the entire area of the reserves, but that for this purpose about one-fifth of the whole area, in convenient blocks, has been set apart and assigned to the Karens.

**Supply of bamboos diminished.**

120. Other objections against the demarcation of the reserved forests in these districts have been raised on account of the people outside the reserves. It has been urged that the forests from which they have hitherto been in the habit of obtaining their supplies of bamboos have now been closed to them, and that they will find it difficult to procure the needful bamboos for their houses.

In the case of villages situated in the immediate vicinity of the forests, the needful arrangements for a free supply of bamboos have been made, either by excluding from the reserves a sufficient area of bamboo-producing forest, or by granting them the right to cut bamboos within a defined area inside the reserves contiguous to their villages.

Villages situated at a distance from the forests may either supply themselves free from the excluded area, or, if they prefer going to the reserved forests, they pay a small royalty (four annas for 100 bamboos generally); but otherwise there is no restriction to their supplying themselves with any quantity wherever they may like to cut them. This system is introduced wherever reserves are demarcated, and it has given rise to no complaints.

Nothing is, as a rule, so beneficial to the development of the teak in the Burma forests as the cutting of bamboos, and instead of placing restrictions on the cutting of bamboos, forest officers do all they can in order to encourage the cutting of bamboos in the reserves.

**Toungya grounds outside the reserves insufficient for the increase of cultivation.**

121. Complaints have also been raised to the effect that the extent of land for toungya cultivation outside the reserves has been curtailed. Thus, in the case of the Nawing forests, it has been urged that, although enough land has been left outside the reserves for present wants, the area left unreserved is not sufficient for the yearly increasing pressure of toungya cultivation. The question at issue being of great importance, it will be useful here to extract the passage in the Forest Settlement Officer's Report in which this objection is urged. This Report is by the late Mr. A. O. Brown, a young civilian of great promise, to whose painstaking energy and sound judgment, while holding the office of Forest Settlement Officer in the Prome and Tharawaddy districts, much of the success in the late work of demarcation is due :

The forests now dealt with are not, and probably never will be, drawn upon by the district for bamboos and other forest produce; nor do they directly affect the interests of permanent wet cultivation. The effect of the outer line on toungya cultivation alone requires remark. It roughly defines the limit which *continuous* hill culture has reached. It has excluded an area sufficient for the adjacent settlements which now exist, but not for the yearly increasing pressure of toungya cultivation in this part of the Prome district. If the forests on the lower slopes of the range are to be protected from denudation, this was not possible. After excluding the area fitted for permanent cultivation (nearly all taken up by cultivators) and Engdeing and other forest naturally unfit for cultivation in any form, the actual ground covered by the toungya cutter in that part of the district which lies between the reserves and the river may be estimated at some 350 to 400 square miles. Extensive as it is, this area is already overworked and yearly deteriorating in its power of production. There are evidences of the pressure everywhere, and its cause seems clearly to be over-

population. As long as the hill villages (formerly pure Burman) were each surrounded by a broad belt of tree forest, their yahs were richer in soil and probably contracted in area; while the cutting rotation was long enough to enable the jungle to recover itself before being again plied by the axe. Gradually the natural increase in population, supplemented by a steady influx from Upper Burma, and coinciding with the rise in prices, reduced the area within which a village without shifting could cut under the old conditions. Partial migrations became more frequent, the "yah" or cutting acreage per head became larger, and the period of rotation less. Under such a state of things, forest denudation becomes a matter of a few years. Assuming that two square miles of toungya grounds per village of 20 houses is a reasonable allowance for its support, without too rapid a cutting rotation, there is reason to believe that in most cases this limit has been already reached; and the consequence is that steady pressure towards the more inaccessible parts of the hill forest will go on until stopped by a precarious water-supply. An outer line drawn at this point would sacrifice two main objects of the reserve, viz., the preservation of teak and of forest for climatic purposes. It is difficult to draw a distinction between toungya as practised on the higher and lower hills. But generally speaking, except where the outer line is drawn specially to include good teak forest, it marks a point at which natural obstacles come in to prevent *continuous* toungya cutting. The included area, if populated, would be peopled with communities isolated from each other and from those outside the line. The whole tract is more or less a teak locality, and some of the settlements nearest the boundary of the reserve are cutting in teak forests which have been as good as, if not better than, any in the reserve. As the toungya system is the source of the food-supply, it is idle to speculate on its being supplanted by any other form of cultivation. We must grasp the fact that while population is increasing, the food-producing power of the inhabited area must gradually decrease. It is not implied that the depopulation which should naturally ensue is imminent, nor is it attempted to specify when it will commence. It may be retarded by many causes. The formation of the *quasi*-reserves we have been consolidating has developed some of these. We have seen small patches of wet cultivation in the valleys extended by artificially causing the silting up of the smaller streams. The Burmans, again, are partially adopting the Khyen practice of ploughing their choungs, and working one choung for two or three years. Facilities for wet cultivation are more carefully utilized. Silk culture and cattle breeding may increase and be improved upon as subsidiary industries. All these may modify, but cannot counteract, the pressure described above; toungya-cutting is a necessity to the immigrant cultivator without money or cattle. As Meaday and Prome are channels through which this immigration largely enters Lower Burma, where large areas are waiting for the plough, our policy, it is conceived, should rather be to promote such emigration towards the plain districts than to enlarge the facilities for the colonization of these tracts in which toungya only can be practised. Already there are a certain number of persons in these hill villages who, having cattle, would benefit themselves by removal to the arable lands in the southern districts, but that their native *vis inertiæ* stands in the way. The proposed reserve may weaken this. The outer line, while it but slighty affects existing interests, will prevent the formation of new settlements, denuding fairly good forest, isolated from each other by a scanty water-supply, ousting the Karen from his "woodlands wild", and cut off from improvement by the difficulty of communications and distance from local markets.

It will be noticed that, though the Settlement Officer expresses doubts as to whether the area left outside the reserves would be sufficient for the yearly increasing pressure of toungya cultivation, he recommends that the boundaries of the reserves be laid down as proposed, and his conclusion doubtless is sound.

Regarding this question, the Conservator furnishes the following additional data, obtained from the Deputy Commissioner's office:

The part of the Prome district referred to is the Myodoung old township, now forming the northern half of the Shwaylay township. It contains a yah-cutting population of 1,619 persons (or, excluding the Karens provided for in the reserve, 1,547 yah cutters) and an area of 4,791 acres of paddy-land. The total area of the Myodoung township is 550 square miles, made up as follows:

| | Square miles. |
|---|---|
| Forest reserves proposed and sanctioned ... ... ... | 207·5 |
| Paddy-land ... ... ... | 7·5 |
| Unreserved and waste lands available for toungya cultivation ... | 335· |
| TOTAL ... | 550 |

If we assume that of the 335 square miles of waste land, 100 miles (a very high estimate) is eng or other unculturable forest, there remains an area of 235 miles available for toungya cultivation

Accepting Mr. A. O. Brown's estimate of the toungya area required, which amounts to 64 acres per house (four acres annually on a rotation of 16 years,

or, what is more likely, three acres on a rotation of 21 years), 1,547 yah cutters would require 154 square miles, leaving an area of 81 square miles available for the extension of this class of cultivation.

But this is not the argument upon which the Forest Settlement Officer bases his recommendation to maintain the proposed boundary. Although, taking the area as a whole, there may be land to spare, yet, in the case of a population chiefly subsisting upon toungya cultivation, the pressure must necessarily be unequal; so that while in some places there may still be room, in others the pressure is felt. Mr. A. O. Brown evidently meant that if an attempt were made to meet the requirements of a rapidly-increasing toungya-cutting population by giving them a larger area, the inevitable result would be the denudation of a larger area. The fact is this—that if population increases rapidly and to a considerable extent by immigration or by natural increase, their food requirements cannot be met by extending the system of toungyas, but only by an extension of permanent cultivation.

If a line is not drawn, inside which toungya cutting is only permitted to the Karens within defined areas, the whole district will be cleared and must eventually deteriorate. These effects are felt most in the dry climate of Prome, but they are felt more or less in all districts where a large population depends chiefly upon toungyas for their maintenance.

**Western Forests.**

122. This closes the review of the forests on the east side of the Irawaddy valley. On the west side of the river, in the civil districts of Thayetmyo, Prome, Henzada, and Bassein, the forests, though very extensive, and though teak is found in them from the frontier to the latitude of Gnatheingyoung, are poor and have been much devastated. Teak in these forests was protected by the proclamation of September 1853, which prohibited the cutting, felling, or marking of teak in the Province of Pegu. It was also protected by the forest rules of October 1856, which prohibited the cutting of toungyas on any spot of ground with more than 50 teak trees on it. But in the earlier years of forest administration in Pegu, no officers or establishments were available for the less valuable forests, and hence not much attention was paid to the protection of these forests. The rules remained a dead letter, and to this day toungyas are cut and burnt without restriction in the midst of teak forest. Paragraphs 24 to 33 of my Report on the Pegu forests for 1859-60 contain the results of a detailed examination of these forests made in 1860; and this account shows that, though at one time there had been in places exceedingly rich teak forests, some containing from four to eight first class teak trees per acre, a large proportion of the trees were mutilated by fire and the axe of the toungya cultivator.

**Thrown open to private enterprize in 1861.**

123. When, therefore, the Government of India, in February 1861, directed that measures should be taken to throw open the Pegu forests to private enterprize, it was decided to sacrifice these forests in preference to any others. Accordingly, long leases were granted, with permission to girdle, for the whole of the western forests. Under these leases the forests were worked from 1862 to 1874, and the teak was not spared by the lease-holders. Subsequently, when the rules of 1865 were made, which defined the limits of the Government forests, the western forests were not included within these limits. They were, however, included in the rules of 1876.

The total quantity of timber extracted from the western forests since 1856 has amounted to 64,945 tons, which is 2,823 tons per annum on an average. These forests, therefore, have yielded as much timber as the Boolay and Choungoungyee, Nawing and Choungzouk, Shwaylay and Shaboung forests taken together.

**Demarcation necessary.**

124. When it was decided not to extend the rules of 1865 to the western forests, it was thought that the forests east of the Irawaddy river and those

in the Sitang valley would be found sufficient to yield the teak timber required by the trade and for local consumption. Since then, however, the mean annual export of teak timber has increased from 76,763 tons to 134,563 tons, and the local consumption from 8,000 to 92,000 tons a year; and under these circumstances it has now become necessary to contemplate the demarcation of teak-producing areas in the western forests also, to be permanently maintained as forest. The first step was to make the forest rules of 1876 applicable to these forests. But, though these rules prohibit the making of toungyas in teak-producing tracts, it has not yet been found possible to enforce this prohibition. Hence it is necessary to push on demarcation as speedily as possible.

Projects for demarcating the best remaining teak forests in the Matoong valley are under consideration, and when these are sanctioned, the enquiry will proceed further south. But it is not likely that in the whole of the western forests more than 250 square miles will be found that are worth reserving for the production of teak, and that can be obtained for Government. On the east side of the river, from the frontier to Myoung-taga, including the Nawing forests not yet finally sanctioned, the demarcated area aggregates 1,285 square miles, not counting Karen areas.

To the teak-producing area in the western forests it will, however, probably be expedient eventually to add forest tracts which produce thitka, thitkadoe, and other valuable kinds.

**Pounglin Forests.**

125. Between the Irawaddy and Sitang valleys are the small valleys of the Pegu and Pounglin rivers.

The following brief account of the Upper Pounglin valley is taken from paragraph 36 of the Pegu Report for 1859-60:

About 56 miles north of Rangoon the Yoma range, which separates the Pegu valley from the tributaries of the Meimakha in the Tharawaddy forest, sends out a spur to the south-south-west, itself pursuing its south-south-east direction. The western spur divides the waters of the Oakkan, Magayee, and Hmawbee choungs, all tributaries of the Hline river, from the western feeders of the Pounglin stream; and after rising once more in the irregularly-shaped limestone hills of the Tounyo toun, terminates at last in the laterite hills which surround the Rangoon Pagoda.

The main spur continues in a south-south-east direction, dividing the valleys of the Pounglin and Pegu rivers, and terminates west of Pegu town. A few miles north of this point of bifurcation of the Yoma range is the Kambaloo toun, one of the more elevated points of the southern Yoma, from the slopes of which I had, on the 6th May 1858, an excellent view of the whole of the valleys to the south, east, and west, revealing at a glance the geography of the greater part of the southern forests. The Pagoda of Pegu was distinctly visible in the clear atmosphere of May, to the south-east, at a distance of about 35 miles, and a slight rise on the horizon to the south was pointed out as the hill of the Rangoon Pagoda.

The Pounglin forests are situated in the wide but short valley enclosed by the two branches of the Yoma range. The spurs of the hills encircling it are covered with excellent teak, but the forests in the plains are nearly exhausted. A very rich forest on one of the central feeders of the Pounglin, the Wasoë choung, is closed by a narrow gorge of rock, which will either have to be blasted or stopped, in order to raise the water above and to render the floating of timber practicable.

The area of the teak localities in the Pounglin valley was in the Report for 1859-60 estimated at 40 square miles, with 22,600 first class teak trees. The estimate embodied in the working plan of 1868 was much less, viz., only 10,000 trees. A detailed account of the lower part of the valley is given in the journal appended to the working plan of 1868 (30th December 1867 to 3rd January 1868).

Since 1856, 2,250 trees have been girdled in the Pounglin forests, and 4,256 tons of timber have been brought out. No proposals for demarcation have yet been made, but it will probably not be impossible to obtain an area of about 40 square miles at the head of the valley.

**Pegu Forests.**

126. The forests in the valley of the Pegu or Zamayee river are among the richest and most important in Pegu. The Zamayee river rises about 120 miles north of Rangoon, its sources being close to the head-waters of the Boben river on the west and the Koon river on the east side. The range of hills which separates this long valley from that of the Sitang river is one of the numerous parallel branches thrown out by the Pegu Yoma on its east side. The head of the Zamayee valley has the character of a table-land with hilly surface, intersected by deep valleys and ravines. The higher hills and ridges on this table-land attain an elevation of 2,000 feet.

In this part of the valley teak is scarce, the forest being evergreen, or evergreen mixed with pyinkado and other leaf-shedding trees. Lower down, however, are some very rich teak forests, which formerly were protected by a long series of rocks in the Pegu river, obstructing the stream for the passage of timber for a length of 20 miles above a narrow passage called the Kyouktaga, or gate of rock, about 70 miles north of Rangoon. The rocks forming this obstruction, and other rocks higher up the river, were blasted in 1862, and since then the forests have been worked regularly.

19,624 trees were girdled in the Pegu forests, and the timber exported since 1856 has amounted to 28,894 tons. Judging from the past yield, these forests are equal in importance to the Shaboung and Shwaylay, but they are much more extensive, and probably contain at the present time a much larger quantity of timber of all ages.

127. The Kyouktaga separates this valley into the Upper and Lower Zamayee. That portion of the Upper Zamayee which contains teak consists of numerous parallel ranges, running frequently in a north-westerly direction and connected by side ranges. The elevation of the higher ranges is from 1,000 to 1,500 feet above the sea. The rock is sandstone and grey shale, often alternating with beds of laminated limestone.

No late valuation surveys of these forests are available, but the following is an abstract of those made before 1868, as recorded in the Working Plan Report of that year:

| Upper Zamayee. | On 4,402 acres. Trees. | Per acre. Trees. |
|---|---|---|
| First class, above 6 feet ... | ... 8,115 | ... 1·84 |
| Second class, from 4′ 6″ to 6′ ... | ... 9,661 | ... 2·19 |
| Third class, from 1′ 6″ to 4′ 6″ ... | ... 16,604 | ... 3·77 |
| **Lower Zamayee.** | **On 795 acres. Trees.** | **Per acre. Trees.** |
| First class, above 6 feet ... | ... 964 | ... 1·21 |
| Second class, from 4′ 6″ to 6′ ... | ... 1,129 | ... 1·42 |
| Third class, from 1′ 6″ to 4′ 6″ ... | ... 1,672 | ... 2·10 |

128. The excess of the second and third class teak trees over those of the first in portions of the Upper Zamayee forests was exceedingly marked before the forest was worked. In paragraph 8 of the British Burma Forest Report for 1861-62 is recorded the following result of eleven valuation surveys, extending over 512 acres:—first class 702, second class 2,613, third class 3,417 trees. On this subject it will be instructive to insert an extract from the report quoted, giving an account of the forest at the time when girdling operations were commenced, which were conducted by Lieutenant (now Major) Seaton:

The rocks which obstruct the floating of timber have hitherto entirely protected the upper forests from the axe of the wood-cutter, but the teak has not been spared from the havoc made by toungya cultivation. The nature of the teak localities on these hills is very peculiar. The stems of the first class trees are tall, regularly shaped, and clear of branches. But the number of first class trees is small, and there are no trees of any large girth. Stems 80 feet long to the first branch are not scarce, but the girth rarely exceeds 8 feet. The average number of first class trees on the square mile observed by Mr. Seaton was, not including the trees girdled during the season, 850. But there are some tracts where large trees were found less scattered.

Near the mouth of the Thaimay choung, a large tributary of the Zamayee to the east, the first class trees are generally at the rate of 1,000 per square mile. In this locality

two fine trees were measured—one in girth 7 feet, length of stem 84 feet; the other 10 feet 7 inches, length of stem 79 feet.

The Upper Zamayee forests are all forests of class C,* that is, the second class trees are more numerous than those of the first nearly four times. As this is very much the case also with the trees of other kinds, the forest has upon the whole the appearance of a young forest. It has already been stated that this is just the opposite of what might be expected of a forest never worked. But it is explained by the following tradition among the Karen inhabitants regarding the former state of the country :

Many years ago these hills were densely inhabited by tribes of independent Karens, who under their own Chiefs kept at bay the Burmans of the plains. This population decreased gradually, and was reduced at last to its present scanty numbers by the famine which followed an unheard-of visitation by rats in 1853. In the Upper Zamayee forests there are now ten Karen villages left. The toungya clearings of these ten villages every year destroy a space of nearly two square miles of forest, and the injurious effect of even this limited toungya cultivation on the teak in the forests is everywhere apparent. Supposing, which is probably not far from the truth, that the hills on the Upper Zamayee, which extend over upwards of 200 square miles, were during the last century inhabited by 50 villages for upwards of 40 years, they must have laid the whole of the country under toungya cultivation; and this being done, moreover, without any restrictions as regards teak, must have destroyed the greater part of the teak trees together with most other large trees. The new forest springing up, while the toungya clearings gradually were reverting to their original character, would after the lapse of 60 or 70 years present exactly the character of the teak localities which now clothe the hills in the Upper Zamayee district, that is, comparatively few old trees would be found, but a large number of trees of the smaller classes.

On the west bank of the Zamayee, below the Kyouktaga, the Khadat forest, measuring 100 square miles, has been demarcated and sanctioned as a reserved forest; and opposite to it, on the east bank, proposals are now under preparation for the demarcation of an area of about 180 square miles, including Karen areas to the extent of 30 square miles.

129. In the Upper Zamayee the Karen population has not of late years materially increased. In 1862 there were ten tays, and now twelve are reported from that part of the valley. It is said that the rule prohibiting the cutting of toungyas in teak localities is now strictly observed by the Karens, and it is believed that as long as this continues, and as long as no outsiders come into the valley, the forest may be left *in statu quo*, demarcation being deferred for the present. This, however, must be made the subject of special local enquiry, for the Upper Zamayee forests are much too valuable to permit their maintenance being risked.

### Forests in the Sitang Valley.

130. In the Sitang valley the only reserves finally sanctioned are the following:

| | Acres. | Square miles. |
|---|---|---|
| **West Sitang.** | | |
| Yaynay forest ... ... ... ... | 5,800 | 9 |
| Swa (East) ... ... ... ... | 17,280 | 27 |
| Khaboung ... ... ... ... | 220,800 | 345† |
| Bhondoung ... ... ... ... | 25,600 | 40 |
| TOTAL ... | 269,480 | 421 |
| **East Sitang.** | | |
| Kannee ... ... ... ... | 60 | 0 |
| Pyounchoung ... ... ... ... | 3,400 | 5 |
| Binbyee (Moong) ... ... ... | 6,400 | 10 |
| Kyone-toung ... ... ... ... | 960 | 1½ |
| TOTAL ... | 10,820 | 16½ |

* NOTE.—When the forests of Burma were first examined, from 1856 to 1862, it was found convenient to divide the teak localities into three classes, as follows :

A—Forests in which the number of first class trees is more than twice the number of second class trees.

B—Forests in which the first class trees are more numerous than those of the second, without exceeding twice their number.

C—Forests in which the number of second class trees exceeds that of the first.

Attaran Report, 1860, page 45.

† This area includes 65½ square miles, or 41,920 acres, assigned to the Karens for toungya cultivation.

Regarding the other forests in the valley, it may be assumed that the following areas will be demarcated.

**Kyouk-ma-sin, Myohla, and Swa Forests.**

131. In the northern section—which is drained by the following streams: Swa and its tributaries, Kyouk-ma-sin, Myohla, and Dounglangya—it is believed that upwards of 250 square miles, including 50 square miles assigned to Karens, will be obtained, apart from the Yaynay and Eastern Swa forests, which have already been sanctioned. This area should include a portion of the Dounglangya and Myohla forests, which are specially valuable, owing to their vicinity to the Sitang river. It should also include the Kyouk-ma-sin forest, on the head-waters of the Kyouk-ma-sin river, a large stream which rises in the Pegu Yoma and, after flowing through Burmese territory, joins the Sitang river about 28 miles above the frontier.

The Kyouk-ma-sin forest has never been worked, and trees have for the first time been girdled in it this year. The remaining forests here mentioned have since 1856 yielded 42,002 tons of timber, 21,460 trees having been girdled. As regards the past yield, these forests may be compared with the Mokka and Beeling forests, but they are much more extensive and doubtless much more valuable.

**Khaboung Forests.**

132. Proceeding southwards, the next forest range is drained by the Khaboung river and its tributaries. In the basin of this river, it has been decided to exclude the greater portion of the hills drained by the three great northern feeders of the Khaboung, viz., the Pabbay, Choung-ma-ngai, and Payaing rivers, the country drained by these streams being studded with Karen tays, and the forest is one continuous mass of toungya ponzohs. Near the main stream of the Khaboung, however, it has been possible to select two large blocks and to demarcate them as reserved forests. The smaller of these two blocks, the Bhondoung reserve of 40 square miles, is situated in the outer range south of the Khaboung river, while the larger block comprises the hills drained by the head-waters of the river and by some of its southern tributaries. The area of the larger block is estimated at 345 square miles, which includes five tracts assigned to the Karens for toungya cultivation, aggregating 65½ square miles.

Since 1856 the forests drained by the Khaboung stream and its feeders have yielded 12,237 tons of teak timber, 10,743 trees having been girdled. Deducting the tracts assigned to the Karens, the reserves (estimated to cover 320 square miles) comprise a little more than one-half of the total area; and although a large extent of good teak-producing forest has been excluded, the area demarcated is most valuable and should be carefully protected and improved.

**Hpyoo and Koon Forests.**

133. On the Hpyoo and Koon rivers extensive Karen areas will have to be provided, and it is estimated that the forest which will remain at the disposal of Government, not including the areas that must be assigned to the Karens, will be about 250 square miles. The yield of the Hpyoo and Koon forests since 1856 has been 25,600 tons of timber, 18,723 trees having been girdled in them.

134. A glance at the map will show that the area of the hills drained by these three streams—the Khaboung, Hpyoo, and Koon—is as large as the total area of the Tharawaddy hill forests, from the Shwaylay to the Thoonzai river. Yet while the Tharawaddy forests have during the last 23 years yielded 197,977 tons of teak timber, the forests on the three streams named have during the same period yielded only 37,837 tons. To some extent this has been caused by certain obstructions which formerly blocked up the Koon and Hpyoo rivers, and which were only blasted in 1865. But this only partly explains the difference. The principal cause is that on the east side of the Pegu Yoma the forests are much more moist than on the west side, and that hence a much larger proportion of the forest is

evergreen, where teak does not grow at all, or is stocked with Pyinkado *(Xylia dolabriformis)* and tall bamboos, where teak has a hard struggle for existence. On the hills drained by the three streams mentioned a large proportion of the ridges are covered with heavy pyinkado forest without teak, and along the valleys it is only the sunny and drier slopes, facing the south and south-west, which are stocked with deciduous forest where teak is found. The shady and moister slopes with a northerly aspect are nearly all clothed with dense masses of evergreen bamboos, with canes and evergreen trees.

**Valuation Surveys made in 1868 and 1880.**

135. But where teak does grow in these forests, it grows with great rapidity and generally forms tall and well-shaped stems. The teak localities, therefore, though limited in area, are extremely valuable; and wherever the interests of the population admit of it, they should all be demarcated.

A remarkable instance of the great improvement which has taken place in the forests of the Hpyoo and Khaboung ranges within the last twelve years was afforded by the examination of the forests near the path which leads across from the head-waters of the Toungnyo stream to Toungoo, between the first camp on the east side of the Pegu Yoma, after crossing from the Tharawaddy side on the Thindeinboot, a feeder of the Hpyoo river, and the Khaboung river, near the mouth of the Hnetpyoo choung. The route followed on the present occasion was nearly the same as that travelled over in January 1868; it runs over a succession of ridges, separating the different feeders of the Hpyoo and Khaboung choungs, which were crossed in succession on this march.

136. The trees of the first three classes which were counted along the line of march in 1868 and 1880 were as follows:

*23rd to 25th January* 1868.

| No. in Forest Survey Journal. | Forest tract. | First class. | Second class. | Third class. |
|---|---|---|---|---|
| 59 | Tsoonchoung forest ... ... | 4 | 5 | 11 |
| 60 | Between the Tsoon and Hpyoo streams... | 75 | 54 | 360 |
| 61 | Between the Hpyoo and the Mwayhouk, a northern feeder of the Hpyoo. | 23 | 35 | 104 |
| 62 | Between the Mwayhouk and the Kwaydoo choung. | 37 | 59 | 33 |
| 63 | Between the Kwaydoo and the Laydoo Kimini choung, both feeders of the Hpyoo from the north. | 4 | 25 | 6 |
| 64 | Ridge on the left bank of the Laydoo Kimini choung. | 19 | 15 | 12 |
| 65 | Between the Laydoo Kimini and the head-waters of the Kadet Myoung, a southern feeder of the Khaboung. | 110 | 88 | 118 |
| 66 | Water-shed between the Kadet Myoung on the left and the feeders of the Hnetpyoo choung, a tributary of the Khaboung. | 97 | 47 | 100 |
| 67 | Forest in continuation of the last, down to the Khaboung stream. | 8 | 7 | 64 |
| | TOTAL .. | 377 | 335 | 808 |

*9th to 12th February* 1880.

| Date. | Forest tract. | First class. | Second class. | Third class. |
|---|---|---|---|---|
| 9th February ... | Between the Tsoon choung and the Ilpyoo choung. | 230 | 366 | 776 |
| 10th ditto ... | Between the Hpyoo choung and the Mwayhouk choung. | 149 | 48 | 282 |
| 10th ditto ... | Between the Kwaydoo and Laydoo Kimini choungs. | 57 | 66 | 104 |
| 11th ditto ... | Between Laydoo and Camp on ridge between the Kadet Myoung and the Hnetpyoo choung, feeders of the Khaboung. | 103 | 146 | 213 |
| 12th ditto ... | Between Camp on ridge and the Hnetpyoo choung, near the Khaboung. | 85 | 124 | 268 |
| | TOTAL ... | 624 | 750 | 1,643 |

137. The area on which the trees were counted in 1868 was 206·4 acres, the aggregate length of the lines surveyed being 17 miles and the average width on which the trees were counted 100 feet, that is, 50 feet on either side of the path. In surveys like these, over broken and hilly country, the width of the tract surveyed cannot be accurately determined. According to the configuration of the ground and the character of the forest, the width of the tract will often be more on one and less on the other side. But approximately the area may be regarded as correct. In 1880 the road was a little longer, the path being somewhat more circuitous, and here and there trees were counted on a width greater than 100 feet. The area to which the countings of 1880 relate may be estimated at 250 acres.

138. Comparing the results of the two surveys, we obtain the following figures:

| Year. | Area in acres. | First class. | Second class. | Third class. |
|---|---|---|---|---|
| 1868 ... ... | 206·4 | 377 | 335 | 808 |
| 1880 ... ... | 250 | 624 | 750 | 1,643 |

These figures show a great improvement in the character of the forest, but they will be better understood if we reduce them to 100 acres:

| Year. | Area in acres. | First class. | Second class. | Third class. |
|---|---|---|---|---|
| 1868 ... ... | 100 | 183 | 162 | 392 |
| 1880 ... ... | 100 | 249 | 300 | 657 |

The teak on this line was not worked between 1868 and 1880, nor had it been much damaged by toungya clearings during that period. In 1868 the aggregate number of stumps counted was 59, and the number of fresh stumps observed in 1880 was very small. During the twelve years which had elapsed between the two surveys the first class trees had increased from 183 to 249 on 100 acres. Assuming that no trees were cut, burnt, or blown down during these twelve years, it is clear that out of the 162 second class trees existing in 1868, 66 or 40 per cent. must have attained a girth of six feet within twelve years.

Hence it may be concluded, with sufficient approximation for practical purposes, that in this part of the forest all sound and vigorous trees, which in 1868 were between four feet six inches and six feet in girth, would within 30 years attain a girth of 6 feet.

During the last twelve years the trees of the second class had increased from 162 to 300. Taking into account that 66 second class trees had attained first class size during the same period, the accession from below during the period in question was 138 + 66 = 204 trees. Neglecting losses by fire, windfall, and toungya-cutting, it follows that out of 392 trees which in 1868 were in girth between eighteen inches and four feet six inches, 204 or over 50 per cent. had attained a girth of four feet six inches in twelve years, and the whole of the 392 trees would attain that size in 24 years. In endeavouring to utilize these conclusions for practical purposes, it must be borne in mind that the figures here quoted relate to one only of the numerous constituents of the forest. On the area surveyed the total number of teak trees in girth above eighteen inches was 7·38 per acre in 1868 and 12 in 1880. But in addition to teak, there were numerous trees of other kinds, and there was an abundance of bamboos. Bamboos and other kinds of trees were cut on a small scale by the inhabitants of the district, while teak was protected. This probably sufficiently accounts for the increase in the growing stock of teak. It is, however, possible that in this case the increase of teak must also be attributed to accidental causes. But the general result of the observations made by me on this tour has been that a great improvement of the forests as regards teak has taken place; and this being so, the surveys here discussed may be accepted as a specimen, which illustrates the general result.

**Future Prospects.**

139. It is clear that in a forest progressing like the tract here discussed, the growing stock of teak must increase considerably. Thus it is not unreasonable to expect that within the next 30 years the trees of the first two classes on 100 acres will stand as follows, provided always that no timber is cut, that no toungyas are made, and that there are no unusual calamities:

| | First class. | Second class. | Third class. |
|---|---|---|---|
| 1868 ... ... | 183 | 162 | 392 |
| 1880 ... ... | 249 | 300 | 657 |
| 1898 ... ... | 345(a) | 492(c) | ..... |
| 1910 ... ... | 549(b) | 817(d) | ..... |

The calculation is as follows:

(a) 183 + 162 = 345; (b) 249 + 300 = 549; (c) for 24 years all (392) third class trees will attain four feet six inches, in six years more some of the younger trees will have come up to that size, and the total of second class trees may thus be estimated at 392 + 100 = 492; (d) 657 + 160 = 817 trees.

No estimate regarding the increase of the third class can be attempted. The accession to this class depends upon circumstances which cannot be foreseen. The springing up of teak seedlings and the development of saplings under eighteen inches in girth, in a mixed forest like those in which teak is found, apart from toungya clearings and other disturbing causes, depend chiefly upon the following circumstances: *first*, the quantity of seed available, number of seed-bearing trees, good seed years, distribution of the seed (chiefly by water); *second*, greater or less violence of the annual jungle fires; *third*, cover overhead. The flowering and seeding of bamboos gives teak seedlings a good chance; but, on the other hand, a vigorous growth of bamboos and other trees prevents the coming up and retards the further development of young teak trees.

**Treatment.**

140. So much is clear that if we consider the teak apart from other trees, heavy cuttings of first class trees might be made in this forest and in forests similarly constituted. Within the next 30 years three first class trees might be cut per acre, without diminishing the stock of trees of that class below the present state. These fellings cannot of course be made all at once, but they might be made in several instalments. The figures quoted in the preceding paragraphs relate to one only of the constituents of the forest. While, under protection, teak is increasing in numbers, other kinds are increasing also, and any plan of cuttings that may be framed must take this fact into consideration. The selection of the teak trees to be felled will require a most careful consideration of all circumstances and of the character of the forest, and a few remarks on this subject will not be out of place here. Broadly speaking, it may be said that in the tracts here noticed two classes of forest may be distinguished, which may briefly be characterised as follows: teak is found either mixed with forest in which pyinkado and other kinds prevail, or in patches and belts, varying in size and of irregular shape, often occupying the tops of ridges which are chiefly or entirely stocked with teak. In forests of the first class the cuttings must be made with the greatest caution, while in those of the second class it will be permissible to cut out all marketable trees, provided there is a sufficient number of the younger classes on the ground. It will also be evident that when teak is cut, the simultaneous cutting of bamboos and trees of other kinds ought to be encouraged to the utmost, so as to diminish the cover and to give young teak ample room to grow up. Giving due weight to these considerations, it will be understood that the whole of the increase of the first class trees expected to take place during the next 30 years (5·5—2·5=3 per acre) must not be cut, unless it is possible to cut out simultaneously a proportion of the bamboos, pyinkado, and other kinds.

The preceding remarks illustrate the great importance of carefully preserving the detailed records of the older forest surveys, those, I mean, which can be depended upon; and of making surveys after a lapse of years according to the same method in the same localities. This subject will be discussed more fully in another part of this Report.

**Bawnee Forests.**

141. The forests drained by the Yainway, Binedah, and Kaw-le-ya rivers, which are commonly known as the Bawnee forests, contain even a larger proportion of teakless forest than the forests further north. A broad belt in the outer hills, skirting the plains of the Sitang valley, is entirely stocked with dense evergreen bamboo forest, the haunt of numberless herds of elephants. Immense trees of thingan, tounsaga (*Michelia*), and other evergreen trees stand out from the mass of bamboos. But both above and below this evergreen belt there are some teak localities which are extremely rich, though limited in extent. As many as fourteen first class trees per acre have been recorded in valuation surveys made on these hills, and the growth of the trees is excellent. In the extract from the valuation surveys appended to the Report for 1861-62, the following results of surveys held in the Binedah and Yainway forest in February and March 1862 are recorded:

| Number of forest tracts surveyed. | Area in acres. | First class. | Second class. | Third class. | By whom surveyed. |
|---|---|---|---|---|---|
| | | Trees. | Trees. | Trees. | |
| 6 | 300 | 300 | 529 | 801 | Dr. Brandis. |
| 12 | 1,360 | 4,283 | 2,363 | 3,045 | Mr. H. Leeds. |

And on page 12 of that Report the following remarks regarding these forests occur:

The teak localities on the hills drained by the Yainway and Peng streams, in the neighbourhood of their confluence, are not much inferior to the best in Pegu. In one locality, on the Nga Yan choung, Mr. Leeds found on the 12th March, along a tract two miles in length, 366 first class trees, of which 156 were in girth above seven feet six inches. This was in addition to 100 trees selected for girdling from among the largest, thus making the number of first class trees per square mile before girdling 9,500, and after girdling 7,400. The trees are described as tall, and the stems regularly shaped. The forest is principally composed of bamboos and a few trees of other kinds. These were Pyinkado (*Xylia dolabriformis*), *Blackwellia tomentosa*, *Terminalia tomentosa*, *Terminalia Chebula*, *Bignonia* sp. (Thanday), *Albizzia Lebbek* (Kokoh).

Many other localities of similar value were found. These forests have evidently never been worked to any considerable extent. There are scarcely any old girdled trees, and the stumps found are the remains of toungya cultivation. The obstructions of the river in the plains have hitherto protected them. The number of first class trees exceeds that of the second class, as is usually the case in such tracts. It is not possible as yet to form an estimate of the total number of first class trees standing in the upper Yainway forests, the higher hills to the westward not having been sufficiently explored. Traces of former toungya cultivation are visible over a large portion of these hills. The new jungle sprung up has the appearance of being about ten years old or more. This circumstance seems to confirm the statements made by the present inhabitants, that prior to the British occupation of the country the number of villages along the Yainway stream and its tributaries was much larger than it is at present, but that many of the inhabitants had originally come across from the hills in the Zamayee district.

Outside the hills there is a considerable area of teak forest in the plains, but though the trees are large and numerous, their value is extremely limited owing to the irregular shape of their stems.

It is hoped that in the Bawnee forests, and on some other smaller streams south of the Koon river, an aggregate area of 100 square miles may be obtained. Part of this area will be valuable as containing thingan. In addition to these proposed reserves in the hills, forests will have to be demarcated in the plains near the proposed railway, to provide locomotive fuel.

### East Sitang Forests.

142. The East Sitang forests are situated between the Sitang river and the foot of the high mountain ranges which separate the Sitang from the Salween and Yoonzaleen rivers. In some of the valleys which are drained by the feeders of the Sitang river teak ascends to 2,500 feet and even higher, and between 1,000 and 2,500 feet teak trees are found in the toungya grounds of the Karens, scattered over vast extents of country; but the timber grown at these elevations cannot be made available for the market. The teak-producing tracts which are important for the export of that timber are situated outside the hills, along the larger tributaries of the Sitang, and on the lower slopes of the hills which skirt these valleys. The area of these teak-producing tracts is exceedingly limited, for they are hedged in by vast tracts of eng forest, which occupy the high ground between the streams outside the hills, by evergreen forest in the valleys, and by the extensive toungya grounds of the Karens, which are stocked with almost treeless bamboo forest.

This description does not apply to all parts of the East Sitang forests alike, but the practical result is, that with few exceptions teak available for the market is only found in limited belts and tracts.

### Bimbyay and Gwaythay Forests.

143. The following extract from the Pegu Forest Report of 1860-61 gives a brief account of the state of the teak localities between the frontier and the Koonoung river in 1861:

The Bimbyay and Gwaythay forests are on the east side of the Sitang river. These streams take their rise from the slopes of the Pounloung mountains to the east, and have, like all other streams on this side of the Sitang river, a good supply of running water

throughout the year. Teak is found on low hills along the stream, the rock being granite. The teak localities are of limited extent and surrounded on all sides by hilly ground covered with Eng (*Dipterocarpus*) forest.

The growth of the timber in these forests is magnificent. The stems are tall, clear of branches, and cylindrical. Under careful working these forests should yield chiefly pieces of from 50 to 80 feet in length. But the floating of logs of such length through the numerous bends of the stream, often rendered narrow by huge granite boulders in the bed, is difficult, and higher up it is almost impracticable. Long pieces will, therefore, have to be carted, and the locality offers no difficulty whatsoever to the construction of good cart-roads, which, owing to the hard nature of the ground, may be used throughout a considerable portion of the year. The following trees measured by me may serve as instances :

| | Girth, measured at six feet from the ground. | Height up to first branch : length of log that might be taken from the tree. |
|---|---|---|
| *Bimbyay Forest, south of Choung, 8th March* 1861. | Feet. | Feet. |
| A tree girdled this year ... ... | 8 | 72 |
| Ditto ditto ... ... | 7 | 106 |
| Ditto ditto ... ... | 8 | 106 |
| Green tree ... ... ... | 16 | 114 |
| A tree girdled this year ... ... | 9 | 78 |
| A fallen tree, cubic contents about 220 cubic feet. | 8 feet at 18 feet from the ground.* | 72 |
| *Gwaythay Forest, south of Choung, 14th March* 1861. | | |
| Green tree ... ... ... | 10 | 91 |
| Do. ... ... ... | 13 | 95 |
| Do. ... ... ... | 11 | 80 |
| Do. ... ... ... | 8 | 84 |
| Do. ... ... ... | 10 | 76 |

* Six feet at 54 feet from the ground.

The Gwaythay forest is one of the most valuable teak-producing tracts in Pegu. The height of the trees is less than in the Bimbyay forest, but they are much younger and the number of growing mast pieces is greater. Out of 101 trees of the first class, counted on the 14th March on a march through the forest of three miles, 79 trees were in girth seven feet six inches and above, and of these no less than 47 were mast pieces, that is, with clear stems more than 60 feet high.

The area of these tracts is limited. I estimate the Bimbyay forest as covering eight square miles. This at 1,460 first class trees on the square mile, which was the result of my survey of the 8th March, would give 11,680 trees in the forest. The Gwaythay forest is supposed to contain a similar number. The results of the forest surveys are that the number of first class trees exceeds that of the second, but is not equal to double its number. Seedlings are rather scarce in some parts, but abundant in others. Of other trees, the most remarkable are padouk (24 trees above six feet in girth among 466 teak trees of the same size), Kokoh (*Albizzia Lebbek*) here and there, and a good number of Tounkalamet (*Cordia fragrantissima*). Do-Ani (*Eriolæna*) attains an unusually large size in this forest; several trees six feet in girth were found with clear stems 40 feet high. This is a valuable wood on account of its great elasticity.

### Koonoong and Kannee Forests.

*Koonoong.*—This forest is far more extensive than either the Gwaythay or Bimbyay, and the trees are of excellent growth, but not of any extraordinary height. Mast pieces were not found to an equal extent. The stream has two main branches—the Koonoong and Shwaydoyah choungs. The former has a clear course, but the latter runs over rapids formed by huge granite boulders, which render the floating of timber impracticable, except with the assistance of elephants. Teak is found both along the streams and on the hills. Forests of *Dipterocarpus tuberculatus* (Eng) cover a considerable portion of the hills, but not to the same extent as in the Gwaythay and Bimbyay districts. Padouk trees are as numerous here as in the Gwaythay and Bimbyay forests, and attain a good size.

South of the Koonoong is the Kannee forest, where teak was planted in 1865 and 1866, which area (60 acres) was declared a reserved forest. An account of this plantation, as it was in 1868, and of the forest in the vicinity, will be found recorded in the journal appended to the working plan report of 1868 (January 29th).

144. The yield of timber and the trees girdled in the Bimbyay and Gwaythay, Koonoong, and Kannee forests since 1856, have been as follows:

| | | | | |
|---|---|---|---|---|
| Trees girdled | ... | ... | ... | ... 24,912 |
| Timber extracted (tons) | ... | ... | ... | ... 40,377 |

The first figure includes 4,218 trees unlawfully girdled by permit-holders between 1870 and 1873. It is probable that the number girdled by them was in reality much larger.

In the working plan of 1868 the area of the teak localities in these three forest districts was estimated at 30 square miles, while the area of teak forest in the Mokka and Beeling districts, which have furnished the same quantity of timber during the same period, was estimated at 140 square miles. The fact is, that, owing to the malpractices of the permit-holders, these northern East Sitang forests were worked far too heavily. Large areas were cleared entirely of all marketable teak, and these forests must now be treated with the greatest care and caution in order to guard against serious deterioration of their productive powers.

**Thouk-ye-gat Forests.**

145. In the Thouk-ye-gat forests a small area of 3,400 acres, on both banks of the Pyoon choung, has been demarcated as a reserve; and here 696 acres have been planted with teak, a detailed account of which will be found in the second part of this Report.

The following extract from the Pegu Forest Report of 1859-60, with a few additions and corrections, gives a brief account of the Thouk-ye-gat forests as they were in 1859:

The Thouk-ye-gat forests extend over a very great space. The area drained by this river, and which may be estimated at about 1,000 square miles, is not quite as large as that drained by the Matoong choung in the western Irawaddy forests. But the Thouk-ye-gat river has more water than the Matoong; its feeders rise from mountain ranges with an average elevation of 4,000 and in some places of 7,000 feet. The Thouk-ye-gat itself comes from the north; but before leaving the hills, about 20 miles east of Toungoo, turns to the west and pursues this direction until it joins the Sitang river. Between its upper course and the Sitang river is enclosed a mountain land, in width nearly 20 miles and rising to an elevation of 5,000 feet. Near the great bend to the west, the river receives two large tributary streams from the south-east—the Kyay choung and the Myit-ngan, and where the Thouk-ye-gat emerges from the hills it takes in a third, the Choung-ma-ngai, from the same direction.

On the whole of the high hills drained by the Thouk-ye-gat river teak has at one time been very generally spread. But the extensive toungya clearings of the Karens on these hills have entirely changed the aspect of the country. Wherever the gradient admits of hill clearings the slopes and ridges are covered with bamboo forest without trees, or with grass jungle composed of species of *Saccharum* and other grasses, some of them identical with the kinds constituting the elephant grass of the plains, but, except in the valleys, not attaining here a height exceeding five feet. From these wide extents of grass land stand out isolated teak trees, with short, gnarled, often forked stems and bushy heads. Only where the slopes of the hills are too steep for toungya cultivation, that is, where the gradient exceeds 30°, the original forest is preserved, and here teak is frequently found forming a considerable proportion of the forest.

The trees of other kinds here associated with teak are not altogether the same as those on the lower hills. Pyinkado is frequent, but with it are found, in larger proportions than usual, Chinjook (*Garuga pinnata*), Theyah (*Shorea obtusa*, Wall.), and Yemeneh (*Gmelina arborea*). Teak on these hills occasionally attains a considerable size. On the 21st May 1859, I found near the Kyay choung, on a steep slope with an average gradient of 40°, a considerable number of fine teak trees, with clean stems above 50 feet high and from seven to nine feet in girth. On the 21st and 23rd May I counted along the path leading from Oo-bo village to Payllowa beyond Bo-ga-lay, the distance being about 20 miles, first class trees not materially injured by hill clearings 54; of these twelve in girth above nine feet; trees mutilated, forked, or otherwise injured by toungya cultivation 443. Yet this is a part where cultivation has spread less than in other side

valleys of the Thouk-ye-gat. In the Myit-ngan valley I counted on two marches, on the 10th and 11th February 1859—

| | |
|---|---|
| Trees of the first class ... ... ... .. | 152 |
| Trees of the second and third classes .. ... | 130 |

Of these, six trees only had stems that might be expected to yield marketable timber; the remainder were all mutilated, forked, or otherwise useless.

At the same time a good number of seedlings constantly spring up. On the same marches I counted in the Myit-ngan valley 107 and in the Kyay choung 201 seedlings. So that, should ever cultivation cease in these regions, the forests would show a rapid improvement.

The Karens who inhabit these hills do not, like those who live on the hills between the Sitang and Irawaddy valleys, select the localities for their toungyas at random here and there in the original forest, shifting the site of their village almost every year; but compelled by the limited space at their disposal, and further induced by the betel palm gardens they have planted in the valleys, they are more steady in their habits, and have actually arrived at something like a regular system of rotation, each toungya being left to lie fallow for three or four years, after which time the jungle is again cut and burnt and paddy sown.

The value of teak in these localities for commercial purposes is very limited. The beds of the rivers are mostly so rocky and irregular, and the slopes of the valleys so broken, that the bringing away of the timber in large quantities to the Thouk-ye-gat river would be a most difficult and expensive operation. Indeed, in many localities the timber may be said to be altogether unavailable. And, on the other hand, if the preservation of the teak were insisted upon in these localities, where for ages past it has served for purposes of cultivation, it is doubtful whether the Karen population at present inhabiting those mountains would continue to find the means of existence. Indeed, it is probable that the first attempt at enforcing the observance of the forest rules would be the signal for universal emigration.

This was an instance calling for the exercise of the authority vested in the officers of the Forest Department by section XI. of the rules of the 21st October 1856,* and the Karen inhabitants of these mountains have accordingly been permitted to carry on their hill clearings, without reference to teak, in localities where the timber cannot be made available for the market. But if they wish to cut timber and use it for the erection of buildings or other purposes, they cannot do so without special license.

We now proceed to the teak localities in the plains and lower hills. They cover the low undulating hills along both sides of the Thouk-ye-gat river, teak being generally found in evergreen bamboo forest of Kyathoung-wa (*Bambusa polymorpha*), and frequently attaining an enormous size. But between the teak-producing tracts wide extents of Eng (*Dipterocarpus*) forests are interspersed, and higher up the river tracts of evergreen forest commence, with Thingan (*Hopea*), *Quercus*, a variety of other trees, rattans, and a large kind of bamboo, Kyello-wa. Granite alternates with laterite, and higher up limestone is found. Teak trees of large girth are common in this forest. They have been left standing, while those of more moderate size have been removed. On the 1st February 1859, in the Kyouk-O forest, on the south side of the river, 265 trees of the first class were observed; of these 166 were in girth above nine feet.

The stems of trees growing on laterite are not very tall and straight; the stature of those growing between the boulders of granite is somewhat better; but the finest trees are to be found higher up the valley, where limestone is mixed with granite. Here several stems 100 feet high were observed perfectly sound and regular. In nearly all the Thouk-ye-gat teak localities the number of first class trees is greater than that of the second. But the number of third and fourth class trees is considerable; so that if the expenditure of first and second class trees is so managed that the trees of these classes last until the third class trees shall have attained the size of first class trees, the preservation of the forest is secured.

146. The area of the available teak localities in these forests was estimated in the working plan of 1868 at 24 square miles, and they have yielded, since 1856, 17,845 tons of timber, 5,873 trees being reported as having been girdled during the same period. In the Thouk-ye-gat, also, illicit girdling by permit-holders was carried on for several years, commencing in 1868, and it is probable that a much larger number was actually girdled than is here stated.

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* Rule XI. of 1856.—"No toungya is to be formed on any spot of ground on which stand any number of teak "trees exceeding fifty, large or small, seedlings included. In special cases the Superintendent or his assistants "may grant permission for toungyas to be formed in such spots where it appears to them that the teak trees "cannot be made available for the use of the Forest Department."

**Remaining East Sitang Forests.**

147. The remaining forests are much less important. The area stocked with teak in them, as estimated in 1868, the number of trees girdled, and the outturn since 1856, appear from the following figures:

| Forests. | Area. | Trees girdled. | Timber extracted. |
|---|---|---|---|
| | Sq. miles. | No. | Tons. |
| Youk-thawa . . | 10 | 5,294 | 5,354 |
| Moong and Pada ... ... | 16 | 8,927 | 11,812 |
| Doonzareet and Shwaygyeen ... | 12 | 59 | 1,679 |

A brief account of these forests, as they were in 1859 and 1861, will be found in paragraphs 46 to 49 of the Pegu Report for 1859-60 and in paragraph 9 of that for 1860-61.

The Binbyee (6,400 acres), which is part of the Moong forest, has been demarcated and declared a reserved forest. The demarcation of another forest in the Shwaygyeen district, the Kyonetoung reserve (area 960 acres), has lately been sanctioned.

**Prospects of Demarcation.**

148. In 1868 the aggregate area of teak localities in the East Sitang forests was estimated at 100 square miles, and it is hoped that, including the small areas already sanctioned in the Kannee, Thouk-ye-gat, and Moong forests, it will be possible to demarcate this area to be permanently maintained as forest. In the West Sitang forests it will be remembered that the aggregate area proposed to be demarcated, not including the tracts assigned to the Karens, amounts to 906 square miles, while in 1868 the teak-producing area on that side, including Bawnee, was only estimated at 300 square miles. This estimate was probably below the mark, but where teak is scattered over a vast extent of hills, as is the case in the West Sitang forests, large areas without teak must necessarily be included within the demarcated areas, in order to obtain good and natural boundary lines.

**Yield of the Sitang Forests.**

149. It is remarkable that the East Sitang forests, where the teak certainly grows on a much smaller area, have, since 1856, produced as much as 77,067 tons of timber; while the West Sitang forests have, during the same period, from a much larger area, produced not more than 84,159 tons. To some extent this is due to the large illicit girdlings in the East Sitang forests between 1869 and 1871; but whatever the cause may have been, the forests on the east side of the valley have certainly been worked too heavily, and must now be treated with great caution, and should for some time to come, be worked but sparingly.

**Girdling Operations.**

150. As regards the number of trees which may be girdled in the forests of the Sitang valley during the next five years, nothing but the most general indications can here be given.

At the outset a distinction must be made between the forests which are likely to be included within reserved forests and those which will be excluded. As far as is known at present, the areas proposed to be included within the reserved forests will admit of girdling operations to the following extent during the next five years:

*Kyouk-ma-sin forests.*—As mentioned in paragraph 131, this forest has never been worked. Its position is peculiar; the timber has to be floated through Burmese territory for a distance of about 40 miles, and then 28 miles down the Sitang river to the frontier. The forest is out of the way, and it would not pay a contractor to undertake the extraction of small quantities. Teak is the dominant tree, mixed with pyinkado and bamboo, chiefly kya-thoung-wa. In places the second class trees are numerous, though those of one

and two cubits in girth are scanty. If light is given by the removal of a portion of the older trees, it is expected that young growth will spring up. 24,700 first class trees have been counted, and it is proposed to girdle 8,000 trees within the next five years, and to await the effect of this operation.

An attempt should be made to sell the girdled timber standing in this forest, under proper precautions. The time within which it should be removed should be strictly limited, and it should be clearly stipulated that all timber left in the forest, standing or lying, after the expiration of the time granted, reverts to Government without compensation to the purchaser, and that the purchaser forfeits the timber on his girdling any teak trees in addition to those sold to him by Government. With these precautions, the sale of the girdled timber standing in this forest may be found advantageous, as it will relieve Government from all responsibility regarding any losses which contractors may sustain beyond the frontier.

151. *The forests on the Siva*, including the Lonyan and Thine rivers and their feeders, have been assessed at an annual maximum yield of 400 trees. This is a very small figure for the large area proposed to be included within the reserves, but a large belt of teak-producing forest will be excluded, where all timber may be cut as soon as it attains maturity.

*The Khaboung forest* is known to be rich in good timber, and the area proposed to be included within the reserves may be estimated as likely to yield a maximum of 800 trees annually.

*For the Hpyoo and Koon rivers*, it has been explained above that, outside the Karen areas, possibly not more than 250 square miles will be available for reserves. More than 1,000 trees annually should not be girdled in these forests during the next five years.

*The Bawnee forests* may be assessed at 200 trees annually during the next five years.

As already explained, the *East Sitang forests* must be worked most sparingly, and it will be better not to girdle any timber in these forests during the next five years.

152. Recapitulating the above, the area expected to be demarcated and the maximum number of trees that may be girdled annually during the next five years in the Sitang forests, as far as they are likely to be included within the reserves, will be—

| Demarcated reserves. | Civil districts. | Estimated area in square miles. | | | Proposed maximum annual yield, 1880-81 to 1884-85. | Mean annual yield of forests, including area outside reserves (average of 23 years, from 1856-57 to 1878-79). | |
|---|---|---|---|---|---|---|---|
| | | Forest. | Karen area. | Total Reserve. | | Trees girdled. | Timber extracted. |
| | | | | | Trees. | | Tons. |
| 1. Kyouk-ma-sin ... | Toungoo. | 236 | 50 | 286 | 2,000 | 933 | 1,826 |
| 2. Myohla and Swa ... | | | | | | | |
| 3. Khaboung ... | | 320 | 65 | 385 | 800 | 467 | 532 |
| 4. Hpyoo and Koon ... | | 250 | .. | 250 | 1,000 | 814 | 1,113 |
| 5. Bawnee ... | Toungoo and Shwaygyeen. | 100 | ... | 100 | 200 | 272 | 188 |
| 6 East Sitang forests ... | | 100 | ... | 100 | .. | 1,959 | 3,407 |
| Total . | ... | 1,006 | 115 | 1,121 | 4,000 | 4,445 | 7,066 |

Note—The timber provided to be girdled by the working plan of 1868, during five years, from 1869 to 1873, was—

| | | | |
|---|---|---|---|
| (1) Sitang, West | ... | 8,000 | or 1,600 per annum. |
| (2) Sitang, East | ... | 4,000 | „ 800 „ |
| Total | ... | 12,000 | or 2,100 per annum. |

The area expected to furnish this yield is estimated at 1,006 square miles. The number of trees proposed to be girdled on this area is larger than it would otherwise be, were it not for the heavy share (1,600 trees a year) assigned to the Kyouk-ma-sin forest during the next five years. The large yield of this forest is, as a matter of course, exceptional and temporary. Omitting this forest, the number of trees expected to be girdled during the next five years within the reserves demarcated and proposed to be demarcated is 2,400 trees a year, which is equal to the quantity provided by the working plan of 1868.

In selecting the trees to be girdled, here as elsewhere, the object to be aimed at should be, to increase the yield and to diminish the cost of bringing the timber to market.

At present there are only four contractors in the employ of Government on the Sitang side; but there is no doubt that if a larger quantity of timber is made available by girdling, a larger number of contractors would come forward; and then it will probably be found more convenient here, as on the west side of the Pegu Yoma, to girdle simultaneously in all forest districts. Until then, the arrangement of girdling operations must be regulated by circumstances.

Besides the trees proposed to be girdled within the reserves, large quantities of timber will be available in the areas which it will probably be necessary to exclude from the reserved forests. But only a very uncertain estimate can be formed of the number of trees that may be girdled in these areas during the next five years.

#### Other kinds.

153. It has been explained that the teak-producing tracts in the Sitang forests, particularly on the east side and in the southern half, are comparatively of small extent, and that forest of other trees prevails. Among these trees of other kinds the following should be noted:

Cutch (*Acacia Catechu*) is found near the frontier, on both sides of the Sitang river, but not in the lower part of the valley. The quantity is insignificant, and need not be taken into consideration in the selection of reserved forests. Cutch boilers pay at present at the rate of Rs. 5 per cauldron per season.

Thitsee (*Melanorhœa usitata*) is common in the eng forests on both sides of the Sitang river, and the charge for tapping is Rs. 4 per man per season.

Pynma (*Lagerstrœmia Reginæ*) is common along streams, more so than in other parts of the province; and Laizah (*Lagerstrœmia tomentosa*) is abundant and very fine in the mixed forests.

Kanyin (*Dipterocarpus*) is abundant in moist forest everywhere.

Thingan (*Hopea odorata*) is common near the banks of all streams, particularly on the Swa, the Binedah, and the Yainway rivers.

Koung-mhoo (*Parashorea stellata*) is often associated with thingan, and like thingan is much prized for boat hulls.

Thinkadoe (*Anisoptera glabra*) is exported in short logs, and is generally used for planking.

Toung-pein-nay (*Artocarpus Chaplasha*) is used for cart-wheels, as also padouk, which is found in the forests east of the Sitang river.

Thitka (*Pentace burmanica*) was formerly not uncommon in the mixed forest outside the hills, in the Western Sitang forests north of the Khaboung river, but large trees have mostly been cut out.

In considering the boundaries of proposed reserves in the Sitang valley, the abundance of any of these or other useful trees should be duly taken into consideration; but with the exception of some tracts peculiarly rich in kanyin, in the Shwaygyeen district, it will probably not be expedient at present to form reserves with the chief object of increasing the production of any of these trees. This, however, must be considered to hold good for a time only, in order to guard against Government being at the outset burdened with a large area of reserved forests not producing revenue. The construction of the railway and

other changes in the communications of the country will doubtless cause the demand for other kinds of wood to increase, and then it will be time to re-consider the policy to be followed in the demarcation of reserved forests.

**Forests on the tributaries of the Salween River.**

154. The following is a brief account of what has been done and what remains to be done in the matter of demarcating reserved forests on the tributaries of the Salween river.

These forests are situated on the Beeling, Doomdamee, Yoonzaleen, Salween, Thoungyeen, and Attaran rivers. The scattered teak forests on the Hlinebway and Houndraw rivers require no mention in the present Report.

**Beeling Forests.**

155. In the valley of the Beeling river have been demarcated the Mainan-nway forest, comprising the hills in the fork above the junction of the Beeling and Mainan-nway streams, area 3,840 acres, and the Maywine forest, area 8,320 acres, above the confluence of the Maywine with the Beeling river, and extending somewhat west of the Maywine and east of the Beeling river.

These two blocks are the only teak forests of importance in the Beeling valley. There are small patches here and there besides, but they are not of sufficient extent to justify their demarcation. A brief account of these forests will be found in paragraph 2 of the Tenasserim Forest Report for 1860-61, and in paragraph 13 of the Report for 1861-62.

156. The only timber girdled in these forests has been 1,003 trees in 1861-62 and 2,000 in 1870-71. Until 1873 they were worked by permit-holders, who brought out the timber on their own account, but were not permitted to girdle. Since 1873 they were worked by contractors, who brought the timber to Moulmein, where it was sold on Government account; and the quantities of timber exported from the Beeling forests have been as follows:

| | Logs. | Tons. |
|---|---|---|
| By Permit-holders— | | |
| (From 1860-61 to 1872-73) ... ... | 1,561 | 1,248 |
| By Contractors— | | |
| (From 1873-74 to 1878-79) ... ... | 2,163 | 1,827 |
| TOTAL ... | 3,724 | 3,075 |

The Beeling forests were demarcated in 1877, and from that time they have been protected against fire. This is done at a trifling expense, the work being done by the Forester in charge.

It is not proposed to demarcate any other forests in the Beeling valley. The population is dense, and the hills on both sides of the valley are everywhere under toungya cultivation.

**Doomdamee Forests.**

157. Three forests in the Doomdamee valley have been demarcated and declared reserved forests, viz.,—

| | | Acres. |
|---|---|---|
| West of the river— | | |
| Shwaygyeen District | Oankangyee .. ... ... | 8,320 |
| | Beelakatgyee ... ... ... | 8,320 |
| East of the river— | | |
| Amherst District .. | Tagayloung .. ... ... | 5,120 |

These three forests are the most important teak forests in the Doomdamee valley, but they are not entirely stocked with teak, a large area being covered with elephant grass and trees of other kinds. They are on level and

undulating ground, and the shape of the stems is, with few exceptions, irregular. Paragraph 15 of the Report for 1861-62 gives a brief account of these forests. 4,822 trees have been girdled in them, viz., 1,549 in 1861-62, 1,273 in 1866-67, and 2,000 in 1871-72. They were first worked by permit-holders, but after 1874 they were worked by contractors, who brought out the timber on account of Government. The outturn has been as follows:

| | | Logs. | | Tons. |
|---|---|---|---|---|
| By Permit-holders— | | | | |
| (From 1860-61 to 1873-74) | ... ... | 5,508 | ... | 3,293 |
| By Contractors— | | | | |
| (From 1874-75 to 1876-77) | ... ... | 6,514 | ... | 3,332 |
| | TOTAL ... | 12,022 | ... | 6,625 |

158. It is probable that some additional areas with teak may be found worth demarcating lower down the valley, between the Doomdamee and Salween rivers, near the Kyoon-mathay choung, a feeder of the Doomdamee.

It is also possible that some areas, producing thingan and thitka, below the present reserves, on the west side of the river, may be found worth demarcating.

Eventually, when the population of the lower part of Martaban has increased, it may be found profitable to sell the timber floated down the Beeling and Doomdamee streams at Beeling and Thatong; but at present the local demand is not sufficient, and whatever timber can be brought from these forests must go to Moulmein.

159. One Forester is in charge of the whole Doomdamee forests; they were demarcated in 1878, and since then attempts have been made to protect them against fire, but success has only attended the efforts made to protect the lower part of the Oankangyee forest. As regards the remainder, the chief difficulty has hitherto been the vast extent of elephant grass along the Doomdamee river, particularly on the west side, extending in broad belts into the heart of the reserve. The difficulty in regard to these savannahs is, that there are extensive stretches of low ground, which do not burn early in the season. The Upper Doomdamee forests are as yet extremely wild and are the haunts of herds of rhinoceros. Until these savannahs are converted into paddy-fields, fire-protection without a heavy annual outlay will remain impossible.

Toungya teak plantations have been established on a small scale in that part of the Oankangyee reserve which is protected from fire.

### Yoonzaleen Forests.

160. The Yoonzaleen river has a length of 112 miles, and it drains a large extent of hills, some of which attain a considerable elevation. The hills near the head-waters, above and some distance below Lomatee, are to a great extent clothed with Pine forests (*Pinus Khasia*). A proposal has been made to demarcate an area of 20 square miles of these pine forests below Lomatee as a reserved forest, because it was supposed that the denudation of these hills might injuriously affect the climate and the general condition of the district, and because the forests may become an important source of turpentine hereafter. I had an opportunity on my tour of examining the present state of the pine forests near the head-waters of the Yoonzaleen river, and of comparing their condition with what they were when I marched through the district twenty years ago; and I do not hesitate to say that there is no present necessity for the formation of any reserved forests in this part of the country. It is true that large areas of pine forest are annually cut and burnt for toungya cultivation; but in the moist climate of the Upper Yoonzaleen the vegetation which springs up on deserted toungyas is extremely dense and luxuriant, and there is, under present circumstanes, no fear

whatsoever of denudation. Landslips do occur, but landslips are unavoidable under a tropical monsoon, even in the most thickly-wooded country.

161. The timber of the Khasia Pine is not durable. Even in the comparatively cool climate of Lomatee, at an elevation of nearly 3,000 feet, it does not last more than three or four years; and the price which it may be expected to fetch at Moulmein will probably not be sufficient to cover the cost of extraction. Unless the population in the Yoonzaleen valley should increase very considerably, there is not likely to be any local demand for the wood. As an experiment, it may be well from time to time to send down to Moulmein small consignments of selected logs of good length, and to watch the result. Large extents of these pine forests are beyond the reach of toungya cultivation, either because the elevation is too great, as on the head-waters of the Prello and Layllo, the two main branches of the Yoonzaleen, or because the soil is too poor, as on the high ridges south-east of the Tabilo stream, on the high road from Lomatee to Karennee, and in many other places.

162. These pine forests doubtless might yield large quantities of turpentine, and I am clearly of opinion that an experiment should be made to determine whether the collection and exportation of this article from these forests will pay. But this experiment will have a much better chance of success in the pine forests on the high range which separates the valleys of the Myit-ngan and Kyay-choung, two southern feeders of the Thouk-ye-gat river. These forests are contiguous to a thickly-populated country, where labour would be available at moderate rates, and whence the carriage to a port of shipment would be practicable without too much expense. If the results were favourable, there would be a good chance of the export of resin from this part of the hills becoming a matter of importance. Whereas near the pine forests of the Yoonzaleen district population is as yet very scanty, and the experiment, if made, would be made under difficult circumstances.

Below the range of the pine the most valuable trees near the Yoonzaleen, as far as our present knowledge goes, are teak, thingan, thitka, pymma, and toungdama.

163. Of teak the only important forests are the Wamoo forest (1,920 acres), three miles above Papoon, which is a reserved forest; the Maitharu or Moo-choung forest below Papoon (2,195 acres), which was demarcated as a reserve in 1871, but thrown open by order of the Chief Commissioner in 1873; and the Sinzway forest (8,960 acres), which is a reserved forest. Besides these, there are numerous small patches of teak in the valley, chiefly on dry ridges clothed with bamboo; but they have been mutilated by toungya cultivation, and are not of sufficient importance to require special notice. Twelve miles above Papoon is a patch of large teak on the hills east of the river, which as far as is known is the upper limit of teak in the valley.

164. In order to secure a permanent supply of the other more valuable woods, the Kaheeloo reserve (9,600 acres) has been demarcated in the lower part of the valley; and it will probably be desirable to demarcate another reserve of about the same size for the same purpose, on the left bank of the Yoonzaleen river, opposite Kaheeloo, and bounded on the north side by the Mepli-choung, on the west by the Kokareet high road, and on the east by the foot of the hills which separate the valleys of the Yoonzaleen and Salween rivers.

### Upper Salween Forests.

165. In the last chapter of this Report a detailed account is given of some of these forests, and proposals are submitted for the demarcation of reserves on the west bank of the Salween, above the mouth of the Thoungyeen river. No tracts have yet been selected, and it is not possible at present to form any

definite estimate of the areas that will be available. The following figures of the proposed reserves must, therefore, be accepted as a rough approximation :

| | Square miles. |
|---|---|
| 1. Maitharouk forests ... ... ... ... | 20 |
| 2. Payllo and Myin-tabyee forests ... ... ... | 40 |
| TOTAL ... | 60 |

**Summary—West Salween Forests.**

166 From the preceding remarks it will be seen that a very small area only will be available as reserved forests in the Tenasserim Circle, west of the Salween river. The area actually demarcated is 85, and the area proposed 75 square miles; total 160 square miles. The yield in teak timber during the 23 years from 1856 to 1879 was as follows :

| | Area demarcated and proposed to be demarcated. Square miles. | Timber in tons of 50 cubic feet. |
|---|---|---|
| Beeling, Doomdamee, Yoonzaleen .. ... | 100 | 13,845 |
| Upper Salween ... ... ... | 60 | 26,661 |
| TOTAL ... | 160 | 40,506 |

The Upper Salween forests were, during a long series of years, worked with the permission to girdle; and it is well known that, as far as teak is concerned, their resources are nearly exhausted. As regards the other forests, only a small portion of the 100 square miles here entered is teak-producing, and this area has, like all forests in the Tenasserim Circle, been worked far too heavily during the period in question.

In these forests fellings of teak must for a long time to come be restricted to the smallest possible quantity.

**Attaran Forests.**

167. A full account of the Attaran forests will be found in a special Report, published in 1860 as the result of an inspection made of these forests during the rains of 1858. The timber brought from the Attaran forests during the first 25 years after the annexation of Tenasserim and the establishment of Moulmein, laid the foundation of the timber trade of Moulmein. These forests were worked under felling licenses granted by Government. The holders of these licenses considered that they had acquired certain prescriptive rights to the timber in the tracts to which the licenses related, but their claims were of the most vague and indefinite character. In 1866, 30 years' permits were given to the license-holders in satisfaction of their claims. These permits authorize the holders to cut and remove all teak timber above seven feet six inches in girth, within the limits as defined in the permits, during a period of 30 years, which will expire on the 1st October 1896. Very little large timber is left in any of the tracts for which these permits were given. Hence the quantity of timber brought out by the permit-holders has been insignificant.

168. The Mittigate and Mittigate-kodogway forests are held on a different understanding, the nature of which, however, is somewhat obscure. In 1849 it was proposed to lease these forests for 99 years, and a memorandum of the conditions proposed to be agreed upon is in existence, a copy of which will be found on page 216 of the Attaran Report. There is, however, no proof that the lease was actually granted. The Mittigate forests have passed from hand to hand, and they are now held by Ramaswamy Rajah, who has of late years, from time to time, brought out small quantities of timber.

The following statement shows the outturn of the Attaran forests* during the three years 1877-78 to 1879-80 :

| Year. | Government tracts. | | | Ninety-nine years lease-holders' tracts (Mittigate). | | |
|---|---|---|---|---|---|---|
| | Logs. | Pieces. | Cubic feet. | Logs. | Pieces. | Cubic feet. |
| 1877-78 ... | ... | 335 | 6,700 | 258 | 546 | 26,550 |
| 1878-79 ... | ... | 477 | 9,629 | ... | ... | ... |
| 1879-80 ... | ... | 244 | 4,880 | 547 | 944 | 50,950 |
| Total ... | ... | 1,056 | 21,209 | 805 | 1,490 | 77,500 |

Note.—No timber was exported during this period by the holders of thirty years' permits.

**Demarcation of Reserves, Attaran.**

169. Beginning with 1877, certain areas have been selected and demarcated as Government forests in the Attaran district, viz.,—

(1.) The *Dalee reserve;* situated east of the junction of the Winyeo and Zammee rivers, and occupying the high ground drained by the Maitharouk, a feeder of the Dalee-choung which falls into the Zammee. The area is 7,680 acres, and it comprises no forests held under permit.

(2.) *Nat-choung forest;* area 5,760 acres; on the right bank of the Zammee river and south of the Nat-choung. This forest also comprises no area held under permit. The teak-producing tracts in this reserve are believed to cover about one-third of the area, and valuation surveys (on 30 acres) give 922 teak trees of the first three classes on 100 acres, of which 130 were of the first class; and in addition to teak, padouk trees of very large size are said to be both numerous and of excellent growth.

(3.) *Goongyee forest;* area 27,520 acres; east of the Zammee river and on both sides of the Goongyee river. This forest comprises some of the best tracts stocked with young teak in the Attaran district, and it contains large numbers of trees of the second and third classes, in girth between 6 feet and 18 inches. The reserve includes portions of the tracts held under permit, known as Nos. 20 and 54. But their area is small, and it is of no practical importance that, as regards this small area, the reserve is burdened by the right held by the permit-holder until 1896 to cut and remove teak trees above five cubits in girth.

* The number of logs and pieces from the Attaran forests entered in the British timber duty book during the same period was as follows:

| | | | |
|---|---|---|---|
| 1877-78 ... ... ... ... ... | none. | | |
| 1878-79 ... ... ... ... ... | 704 | logs and | pieces. |
| 1879-80 .. ... ... ... ... | 669 | do. | do. |
| Total ... | 1,373 | do. | do. |

(4.) *Kyoonchoung reserve;* area 10,880 acres; on both sides of the Kyoonchoung, an eastern feeder of the Zammee river. This forest includes a portion of the tract known as No. 51, which is held under permit. At one time the Kyoonchoung forest must have been magnificent; this is proved by the large number of huge stumps still standing. Fires have been most destructive, and hence the young growth of teak is not very plentiful throughout; but it is proposed to keep out fires and to plant teak in toungyas, which will certainly have the effect of improving the forest.

(5.) *Megwa forest;* area 12,160 acres; comprises the hills at the head-waters of the Megwa river, between the Zammee and Winyeo. This forest includes part of tract No. 50 held under permit. It is on hilly and undulating ground, is chiefly stocked with bamboos, and has not only suffered by excessive working in former years, but also by toungya cultivation.

(6.) *Thingan-neen-noung forest;* area 5,760 acres; comprises part of forest No. 16 held under permit, and includes a teak plantation made on the banks of the Winyeo river in 1856. The forest is situated chiefly on the east bank of the Winyeo river, and joins on to the Megwa reserve. It is partly stocked with evergreen forest, in which thingan is plentiful. An account of the plantation is given in paragraph 146 of the Forest Report for 1876-77. A remarkable fact is recorded in that Report, viz., an abundant growth of thingan seedlings under the young teak trees around an old thingan tree that had been spared in the plantation.

(7.) *Maoo reserve;* area 8,960 acres; on low hills between the Zammee and Winyeo rivers, along the head-waters of the Maoo stream. The teak is found on level and undulating ground along the banks of the stream. This reserve includes tracts Nos. 32, 33, and 34 held under permits.

(8.) *Pakaboa reserve;* area 20,480 acres; on low, undulating hills between the Zammee and the Winyeo stream, and along the head-waters of the Pakaboa choung, a feeder of the Winyeo. This forest contains a large quantity of teak of the smaller classes, with tall, regular, well-shaped stems. The best teak is on the Bokado stream, a feeder of the Pakaboa. The southern part is stocked with bamboos, and is admirably adapted for cultivating teak in toungyas. No tracts held under permits are included in this reserve.

These reserves in the Attaran are admirably selected. Their great value consists in their excellent soil and the good growth of young teak which they contain. A large proportion of the second class trees now in the forest will attain a girth of 6 feet within the next 25 years. The area of these reserves aggregates 155 square miles, and they will in time be extremely valuable. The growth is rapid, the timber can be sent to Moulmein at very little cost and at all seasons of the year. The timber trade of Moulmein owes its existence to the impulse which the working of the Attaran forests has given to it; and although the result at the time was the exhaustion of these forests, the natural conditions in this district are so favourable for the growth of teak, that there is every prospect that under careful management these forests will revive and will furnish in future a regular annual supply of excellent timber. It should be considered whether the area of reserved forests in the Attaran cannot be increased.

**Thoungyeen.**

170. An account of the Thoungyeen forests will be found in paragraphs 21 to 29 of the Report for 1859-60, and in paragraphs 17 and 18 of the

Report for 1860-61. They contain the only extensive teak localities in the Tenasserim Circle, and although they have been much worked out, there is still a large area of forest rich in trees of the smaller sizes.

The demarcation of the following areas has been sanctioned:

*Meplai reserve*, 20 square miles, in the valley of the Meplai river, a large tributary which, coming from the north, runs parallel with the Thoungyeen for a length of about 25 miles, and joins that river a few miles north of Myawadee.

*Kamokla and East Meplai reserves*—two blocks between the Thoungyeen river and the range of hills which separates the Thoungyeen and Meplai valleys. *Kamokla* is a block estimated to measure about 9 square miles, below the famous gorge of that name, through which the Thoungyeen forces its way. Major Seaton estimates that six square miles are teak-producing, with a total of 18,000 trees of 18 inches and upwards in girth. The *East Meplai* block extends for fifteen miles along the bank of the river, and is estimated to cover 60 square miles, of which sixteen are believed to be teak-producing, with a growing material of from 80,000 to 100,000 trees, 18 inches and upwards in girth. This block is also said to be rich in Thitsee (*Melanorhœa usitata*), thingan, and padouk.

The *Mekkanay reserve* comprises the hills which separate the Thoungyeen from the Mekkanay stream, a tributary of the Meplai which joins that river from the south. The area of this block is estimated at 30 square miles, of which five are teak-producing, with from 15,000 to 20,000 trees, 18 inches and upwards in girth. This block comprises about 8 square miles of Pine forest (*Pinus Merkusii*), which some day may acquire great importance on account of its yield of resin. From this reserve have been excluded some fine teak localities near Myawadee which, as Major Seaton reports, are conspicuous for the excellent and rapid growth of the timber. These, as well as other good teak localities which have been excluded, might perhaps be separately demarcated. For although small blocks are generally to be avoided if isolated, their protection and good management can generally be arranged for if they are in the immediate vicinity of larger blocks.

The *Kyoukket block*, estimated at 19 square miles, on the banks of the Thoungyeen, has also lately been sanctioned.

The *Mehgala* is a reserve near the mouth of the stream of that name, estimated at 10 square miles, of which three are believed to be teak-producing, estimated to contain between 18,000 and 20,000 trees of the first three classes (18 inches in girth and above). Some of the tracts on level ground near the junction of the Mehgala stream with the Thoungyeen are particularly rich; the stature of the trees is good and the growth rapid. The valuation surveys gave the following results per acre:

| Locality. | First class trees. | Second class trees. | Third class trees. | Total Teak. |
|---|---|---|---|---|
| Near the mouth ... ... | ·74 | 1·30 | 20 3 | 22 |
| Higher up the stream ... | 1·18 | 0·66 | 8·7 | 10 |

This reserve also comprises a considerable area of pine forest.

171. In the Upper Thoungyeen, above the mouth of the Mehgala, it will probably be best to demarcate one large block, comprising a vast extent of low hills between the Gawlee and the Onkraing rivers. A large portion of these hills is stocked with teak, and the area of the proposed block may roughly be estimated at 200 square miles, of which about 50 square miles will have to

be excluded and be set apart for toungya cultivation by the Karens, leaving 150 square miles as forest. This large reserve may be called the Gawlee forest.

172. In the Lower Thoungyeen, below the Kamokla block, it is believed that the area of teak forest available for demarcation will not exceed 30 square miles. An attempt will be made to export boat hulls of thingan from the Lower and Middle Thoungyeen. The difficulty consists in this, that thingan does not float and that it must be brought over the rapids in the Salween river by means of coolies. It has also, I understand, been proposed to construct a cart-road from Kokareet to Myawadee, and this would make it possible to cart padouk, thingan, and other timbers which will not float to the Houndraw river, and to convey them by boats to Moulmein. Hence it will probably be desirable to demarcate a certain area of forests producing thingan and padouk in the Thoungyeen. This, however, must remain for consideration at some future time.

173. During the 23 years from 1856-57 to 1878-79, the Thoungyeen forests have yielded a total outturn of 133,314 tons of teak timber, the number of trees girdled on account of Government during the same period having been 14,677. There is, however, reason to believe that during this period a much larger number of trees was girdled by the Karens without authority from Government. The yield of the Thoungyeen forests has been nearly the same as that of the Southern Tharawaddy forests from the Boben to the Thoonzai during the same period. Nor is there any great difference in the area demarcated and proposed to be demarcated of these two groups of forests. The following figures will illustrate this remark:

| | Area demarcated and proposed to be demarcated. | Yield in tons of 50 cubic feet. |
|---|---|---|
| | Square miles. | |
| Thoungyeen ... ... ... | 328 | 133,000 |
| Boben to Thoonzai ... ... | 386 | 145,000 |

But there is no doubt that although the area proposed to be demarcated in the Thoungyeen is nearly as large as that already demarcated in the Southern Tharawaddy forests, the teak-producing tracts are much less extensive, and that during the period in question they have been worked much more heavily than was justified by their condition. This was recognized when the working plan of 1868 was framed, which allotted only 2,000 trees to be girdled during the five years from 1869 to 1873, or at the rate of 400 trees a year; while to the Tharawaddy forests in question 13,000 trees were allotted for the same period, or 2,600 trees a year. The heavy over-fellings which have unfortunately taken place in the Thoungyeen must mainly be ascribed to the circumstance that until 1876 there was only one Conservator in Burma, who resided at Rangoon, and whose attention was taken up almost entirely by the care of the Pegu forests, the control of the working and management of the forests in Tenasserim being left to subordinate officers.

**Pandaw and other forests.**

174. There are remains of former teak forests on the Houndraw and Ilinebway rivers, as well as on Koloon island and near the east bank of the Salween above and below Shwaygoon.

Of these, the Pandaw forest above Shwaygoon is of some importance. At present it only yields small timber, but a considerable quantity; and owing to the vicinity of the Salween river, its produce is carried to Moulmein at very low rates. During the last 20 years, from 1859-60 to 1878-79, the Pandaw forests have yielded an aggregate of 57,689 logs, equal to 22,698 tons of timber. The forest is held under a permit similar to those in force in the Attaran

forests, so that, strictly speaking, the holder is not permitted to remove any timber under 7 feet 6 inches in girth. The condition as to the size of the timber removed has not, however, hitherto been enforced.

No proposals are submitted at present regarding the management of these forests, or the demarcation of reserves in them.

**Summary.**

175. The following is a summary of the areas demarcated and proposed to be demarcated in the Pegu and Tenasserim Divisions of British Burma, not including the areas assigned to the Karens :

| Forest. | Civil district. | Areas in square miles. | | |
|---|---|---|---|---|
| | | Sanctioned. | Proposed. | Total. |
| I.—West of the Irawaddy River ... | Thayetmyo ... ... Prome ... ... Henzada ... ... Bassein ... ... | ... | 250 | 250 |
| II.—Between the Irawaddy River and the Pegu Yoma. | Thayetmyo ... ... Prome .. .. Tharawaddy .. .. Hanthawaddy ... ... | 1,180 | 105 | 1,285 |
| III.—Pegu and Pounglin ... .. | Hanthawaddy .. ... | 100 | 190 | 290 |
| IV.—Sitang, West ... .. | Toungoo ... ... Shwaygyeen ... ... | 356 | 550 | 906 |
| V.—Sitang, East ... ... | Toungoo ... ... Shwaygyeen ... ... | 16 | 84 | 100 |
| | Total Pegu Circle ... | 1,652 | 1,179 | 2,831 |
| VI.—Beeling ... ... | Salween ... ... | 19 | ... | 19 |
| VII.—Doomdamee ... ... | Shwaygyeen ... ... Amherst ... ... | 34 | ... | 34 |
| VIII.—Yoonzaleen ... ... | Salween ... .. | 32 | 15 | 47 |
| IX.—Upper Salween ... ... | Salween ... ... | ... | 60 | 60 |
| X.—Attaran ... ... | Amherst ... ... | 155 | ... | 155 |
| XI.—Thoungyeen ... ... | Amherst ... ... | 148 | 180 | 328 |
| | Total Tenasserim Circle ... | 388 | 255 | 643 |
| | Grand Total ... | 2,040 | 1,434 | 3,474 |

This is the present programme of what is proposed to be done in the matter of demarcation. Two questions arise in regard to these figures—*First*, whether the area may be regarded as sufficient to meet the objects in view; and, *second*, whether the demarcation of this area will not tend to impede the extension of cultivation.

**Annual yield expected from the area proposed.**

176. As regards the first point, it should be borne in mind that the whole of the area proposed to be included within the reserved forests will not be teak-producing. It has been stated, in paragraph 16 of this Report, that the total area of teak-producing forest in Pegu and Tenasserim may be estimated at 2,400 square miles in round numbers. It has also been explained that considerable areas of teak-producing forest have been excluded. If the reserves as finally demarcated contain 2,000 square miles of teak forest, this is, I fear, all that we can expect to attain. In the first chapter of this Report it has been shown that the mean annual consumption of teak timber, supplied by British Burma and the countries beyond its inland frontier, during the five years from 1874-75 to 1878-79, has been 227,149 tons;

that this quantity is not likely to decrease, and that endeavours must be made to place the Government forests in British territory in such a position that they can supply as large a proportion as possible of this quantity.

It has also been stated (paragraph 14) that during the next 40 years it is hoped to maintain the mean annual yield of the British forests at the same figure as during the last 23 years, viz., at 35,000 tons. Assuming that Government obtains complete control over 2,000 square miles of teak-producing forest, and neglecting the yield of the teak localities excluded from the reserves, 35,000 tons would correspond to a yield of 17·5 tons per square mile, or 1·37 cubic feet per acre per annum. This is a very small yield, and with efficient protection and under systematic working it ought not to be difficult to maintain this outturn.

177. Eventually, after the condition of these forests has improved, and after the proportion of teak in them has been increased, a much larger yield may confidently be anticipated. From the description of a forest tract in the Hpyoo and Khaboung district given in paragraphs 135 to 140 of this Report, it appears that if the valuation surveys made in 1868 and 1880 can be relied upon, and if a corresponding proportion of bamboo, pyinkado, and other trees is cut out, 3 mature trees per acre may be cut during the next 30 years in the area surveyed in these forests. This would correspond to an annual yield per acre of $\frac{3 \times 75}{30} = 7{\cdot}5$ cubic feet. At this rate 2,000 square miles of teak-producing forest of similar quality might be expected to yield 192,000 tons of timber. So large a yield, however, from the whole area in question, presupposes that the 2,000 square miles are all stocked as well with teak as the 250 acres surveyed in February last; and besides this it presupposes many other conditions which have not yet been fulfilled, the chief being that the forests must be opened out completely for the export of timber, that they must be protected against fire, and that a corresponding demand must spring up for bamboos and other kinds of trees. In Europe a mean annual yield of 7·5 cubic feet per acre would be a very poor outturn, with which, under ordinary circumstances, no forest proprietor would be satisfied. The difference is this, that in the forests of Burma only one kind of tree (teak), and of the trees of that kind a portion of the wood only, can be utilized, while the other kinds, which constitute the great mass of the forests, and the tops and branches of the teak trees are worthless. In Europe, on the other hand, the whole of the wood of all trees constituting a forest is utilized, and hence the annual yield per acre of marketable produce is much higher. We do not, of course, expect to bring the whole of the 2,000 square miles of teak-producing forest which we hope to have at our disposal into a state to yield at the rate of 7·5 cubic feet of timber per acre per annum. But what we aim at is, to increase the proportion of teak on selected areas to such an extent that these areas will yield the requisite quantity. So much, however, is clear, that it is not unreasonable to expect that a steady system of improvement will have the result of eventually bringing up the yield of the forests proposed to be demarcated to 200,000 tons a year. This end, however, cannot be attained unless the forests are demarcated as has been proposed, and unless the means are given for their efficient protection and steady improvement.

**Will the demarcation of Reserved Forests interfere with the extension of cultivation?**

178. The second question is, whether the formation of the reserves as here proposed will not interfere with the extension of cultivation. It has been maintained that, considering the moist climate of the province, forests are unnecessary, and that it would be better to convert into paddy-fields the whole of the Burma forests. This, however, is physically impossible, for these forests are situated on hills and mountain ranges which cannot be converted into permanent paddy-fields. But even if there were no hills, and if the whole country could be converted into a vast paddy-field, the clearance of all forests would be a misfortune which would seriously impair the fertility of the

country. Indications are not wanting that in the Delta and in some of the open tracts of the Irawaddy valley, and on the lower hills of the Prome and Thayetmyo districts, denudation has already gone too far. There is no shelter for the cattle against the fierce sun of the dry and hot months, from February to May, which precede the rains. During that season there is no fodder, and the sudden abundance of green fodder, which springs up at the first burst of the rains, after a time of starvation, is believed to be the cause of much of the cattle disease which at times has been a real difficulty in these parts of the country.

**Proportion of Reserved Forests to total area in the different districts.**

179. The reserved forests demarcated and proposed to be demarcated are situated in ten out of the fifteen districts of the Pegu and Tenasserim Divisions. The following statement shows the areas of cultivated and waste land, taken from the Administration Report for 1879-80, the reserved forests existing and proposed in each district, and the percentage of reserved forests to the total area of the districts:

| Districts. | Area in square miles. | | | | Percentage of reserves to total area. |
|---|---|---|---|---|---|
| | Cultivated. | Waste. | Total. | Reserves. | |
| 1. Hanthawaddy ... ... | 1,291 | 2,945 | 4,236 | 549 | 12·9 |
| 2. Bassein .. .. | 580 | 6,467 | 7,047 | 50 | ·7 |
| 3. Henzada ... | 389 | 1,559 | 1,948 | 50 | 2·5 |
| 4. Tharawaddy ... ... | 278 | 1,736 | 2,014 | 561 | 27·8 |
| 5. Prome ... ... | 358 | 2,529 | 2,887 | 378 | 13·09 |
| 6. Thayetmyo .. ... | 185 | 2,212 | 2,397 | 237 | 9·9 |
| 7. Amherst ... . . | 520 | 14,669 | 15,189 | 491 | 3·2 |
| 8. Shwaygyeen ... ... | 161 | 5,406 | 5,567 | 146 | 2·6 |
| 9. Toungoo ... ... | 79 | 6,275 | 6,354 | 886 | 13·9 |
| 10. Salween ... ... | 21 | 4,625 | 4,646 | 126 | 2·7 |
| | 3,862 | 48,423 | 52,285 | 3,474 | 6·6 |
| 11. Rangoon town ... ... | 2 | 20 | 22 | ..... | ..... |
| 12. Thonegwa ... ... | 356 | 5,057 | 5,413 | ..... | ..... |
| 13. Moulmein town ... ... | 13 | 1 | 14 | ..... | . . |
| 14. Tavoy ... ... | 124 | 7,026 | 7,150 | . .... | ... . |
| 15. Mergui ... ... | 82 | 7,728 | 7,810 | ... .. | ..... |
| Total of Pegu and Tenasserim .. | 4,439 | 68,255 | 72,694 | 3,474 | 4·7 |

180. The proportion of reserved forests will be largest in Tharawaddy, where they will occupy one-fourth of the total area of the district. This is because the most valuable forests are situated in that district. The population is given in the Administration Report for 1879-80 as 240,945 souls, and the area is distributed as follows:

| | Square miles. | | Acres. |
|---|---|---|---|
| Cultivated area ... ... ... | 278 | or | 177,920 |
| Culturable waste ... ... | 995 | or | 636,800 |
| Unculturable waste ... ... | 180 | or | 115,200 |
| Reserved forests ... ... | 561 | or | 359,040 |
| Total area ... | 2,014 | or | 1,288,960 |

Of the reserved forests 100 square miles have been counted as culturable and 461 square miles as unculturable area.

In so far certainly the demarcation of reserved forests interferes with the extension of cultivation, that the area of the reserves is not available for such extension. But the culturable area included within reserved forests is very small, and forms an insignificant proportion of the total area of the district; and it is clear that, when demarcation is completed, a large area of culturable waste will remain available for the extension of cultivation.

**Conclusions.**

181. Burma is still essentially a forest country. This is illustrated by the following figures, which have been taken from the Administration Report for 1879-80:

| Civil Division. | Area in square miles. | | | Area of reserved forests, in square miles. |
|---|---|---|---|---|
| | Cultivated. | Waste. | Total area. | |
| | | Culturable. | Uncultur-able. | |
| Arakan ... ... ... | 895 | 1,593 | 12,038 | 14,526 | ..... |
| Pegu ... ... ... | 3,439 | 14,137 | 8,388 | 25,964 | 1,825 |
| Tenasserim ... ... ... | 1,000 | 21,201 | 24,529 | 46,730 | 1,649 |
| Total ... | 5,334 | 36,931 | 44,955 | 87,220 | 3,474 |

With the exception of the savannahs on low ground in the Delta and near the great rivers, the area of which may be estimated at 5,000 square miles, the whole province outside the cultivated lands, or, say, 77,000 square miles, is forest, and of this area it is intended at present to demarcate only 3,474 square miles to be permanently maintained as forest. Thus, if the proposals of the present Report are accepted, the percentage of cultivated, waste, and reserved forest will be about as follows:

| Division. | Percentage of | | | Total. |
|---|---|---|---|---|
| | Cultivated land. | Waste. | Reserved forests. | |
| Arakan . . | ... 6 | 94 | ... | 100 |
| Pegu . . | ... 13 | 79 | 8 | 100 |
| Tenasserim | ... 2 | 94 | 4 | 100 |

In the Pegu Civil Division alone the reserved forests are seven and in the Tenasserim Civil Division they are 3·5 per cent. of the total area.

These figures will suffice to remove any apprehension that the demarcation of reserved forests, as at present proposed, will have an injurious effect upon the extension of cultivation in the province.

# CHAPTER V.

## PROTECTION AND IMPROVEMENT.

182. The total forest area which it is at present contemplated to set apart in the Pegu and Tenasserim divisions of British Burma, chiefly for the production of teak timber, amounts to 3,474 square miles. In its present condition this area can only yield a very small proportion of the teak timber which is annually consumed in Burma and exported to other countries. During the next 40 years it is hoped to maintain the mean annual yield in teak timber of the forests in British territory at the same figure which has been maintained during the last 23 years, viz., 35,000 tons per annum. But the present consumption of teak timber, as far as the Burma trade is concerned, amounts to 227,000 tons per annum, and it is evident that the productiveness of these forests as regards teak must be considerably improved before we can expect to obtain a yield approaching to this figure.

### The proportion of teak in the forests must be increased.

183. If the forests were pure teak forests, and if the whole demarcated area were capable of producing teak, the annual yield of 2,000 square miles would be a very large quantity, considerably more than the quantity at present consumed in the Province and exported to other countries. But the forests are not pure teak forests. The tree forms only a very small proportion of the forest, and large areas will necessarily be included within the forests proposed to be demarcated on which teak can never under any circumstances be made to grow. Our aim is not to grow pure teak forests. The tree thrives best if associated with bamboos and other trees, and it will be well in this respect to follow the indications of nature. Pure, or nearly pure, natural teak forests are rare, and where they are found their condition is not satisfactory.

But though we may not desire to form pure teak forests, yet our aim must be to increase the proportion of teak in the forests, and thus gradually to enable the demarcated area to produce the quantity needed to meet the requirements of the Province and of export trade. The 3,474 square miles now proposed to be demarcated will probably never be capable of yielding the entire quantity required for the Province and for export. It may be necessary to demarcate additional areas, or other permanent sources of teak timber may become available; but whatever the contingencies of the future may be, it is clear that we must endeavour to increase considerably the proportion of teak in the forests of which we undertake the management.

### Boundary lines.

184. Before, however, we can speak of works of improvement, the protection of the forests must be secured. In this respect the first point which demands our attention is the condition and maintenance of the boundary lines, not only the outer boundaries, but also those lines which define the portions of the reserves assigned to Karens for toungya cultivation.

To keep boundary lines clear is troublesome in Burma, and yet they must be kept clear. Nothing is wanted but a narrow cleared path, fit for riding wherever practicable, under the shade of the forest left standing on either side, following the boundary line wherever the ground permits, and diverging from the boundary line wherever such may be necessary. Three classes of boundary marks are in use at present:

*First.*—Continuous lines of blazed trees, with flat marks cut into the stem, generally marked V. R. As far as they go, continuous lines of trees thus blazed are useful marks, but they are not sufficient.

*Second.*—Mounds of earth, with posts let into them, have been used here and there, but, except in the drier frontier districts, I doubt their permanence in the climate of Burma.

*Third.*—Boards of teak wood nailed on trees, eight feet above the ground, have answered best. Hitherto the dimensions were 18 × 12 × 1 inch; these boards required two long nails to hold them, so as to keep the board several inches off the bark. While in Burma I agreed with the Conservators upon a modification which will be an improvement upon the present plan. In future the boards will be 4 inches wide and 1½ inches thick. They will only have half the weight, they will be packed more easily on an elephant, they will require one nail only, and they may be let into the bark of trees without fear of their splitting.

185. Accurate maps are not yet available to facilitate the discovery and prevention of encroachments, nor can we at present afford the outlay required for the preparation of such maps. But if cleared paths are maintained along and near the boundary lines, if boards painted white with running numbers are let into large trees at convenient distances, and if the boundaries are periodically patrolled by the Forester in charge, it ought to be possible to discover and to prevent encroachments.

**Protection.**

186. With few well-defined rights in the reserved forests, with the areas assigned to Karens for toungya cultivation clearly determined and marked off, with boundary lines all round the reserves and the Karen areas so well marked that they cannot be mistaken—the protection of the reserved forests against cutting and ordinary damage ought not to be difficult. The great advantage of the system of demarcated reserves is that the work of protection is limited to defined areas, in which the rights of all concerned have been clearly defined and are well understood.

**Protection against fire.**

187. So far regarding protection against encroachments, cutting, theft, and ordinary damage. Protection against fire is a more difficult task, and it certainly is specially difficult as a rule in the teak forests of Burma. The exceptions are where teak forests are surrounded by toungya grounds which the Karens protect against fire. Such cases are not uncommon in the hills between the Sitang and Salween rivers, where in certain tracts the Karen population is so dense that the forest, which they clear and burn in a short rotation, deteriorates unless fires are carefully excluded from the whole area.

It would greatly facilitate the improvement of the forests if the Karens, who occupy the areas assigned to them in the reserves of the Pegu Yoma, could gradually be induced to exclude fire from their toungya grounds. They would find it pay, for the forest would grow up thicker and their toungyas would give heavier crops. This will be the next great step of progress which should be attempted in the management of these Karen areas.

**Methods employed.**

188. In Burma, as in other Provinces, the chief work done to ensure the protection of forests against fire is to surround them by fire-traces, to keep these fire-traces clear of all inflammable matter, and to burn the grass outside the area which it is intended to protect. It is still an open question in Burma whether it is better to have broad fire-traces clear of trees, or narrow traces with trees and bamboos to shade them; and probably no rigid rule can be laid down which shall be applicable to all parts of the Province.

Good results are expected from the planting of belts of evergreen trees on the outside of fire-protected areas and on internal sub-division lines. Such belts have been planted in Magayee, and the experiment should be steadily continued. Such belts will doubtless be useful in certain cases, but they

must not be expected to afford absolute protection. Evergreen trees shed their leaves like other trees, and the only difference is that they are never wholly leafless. The ground under such trees, therefore, must be kept clear of dry leaves and other inflammable matter; but the advantage will be that if the belt is well stocked with evergreen trees, there will be no grass and brushwood.

**Areas protected in Pegu.**

189. Meanwhile, fire protection can only be attempted in these forests on a small scale. The following is a list of the areas which were actually protected during the hot weather of 1880 in the Pegu Circle:

| Civil district. | Forest tract. | Area protected in 1880. | Outlay in 1879-80. | Year when fire-protection commenced. |
|---|---|---|---|---|
| | | Acres. | Rs. | |
| Prome ... | Choungzouk ... ... | 2,150 | 395 | 1879 |
| | Prome plantation... ... | 75 | 25 | 1857 |
| | Bwet (Shwaylay)... ... | 2,886 | 816 | 1877 |
| Tharawaddy... | Nyanlay (Toungnyo) ... | 5,240 | 1,237 | 1877 |
| | Kangyee (Minboo) ... | 3,801 | 988 | 1877 |
| | Gway-douk-tsan (Boben) ... | 26 | 37 | 1879 |
| | Boben Choungwa ... | 597 | 154 | 1869 |
| | Myodwin ... ... | 40 | 45 | 1869 |
| | Myoung and Minhla Choungs (toungya plantations). | 232 | 310 | 1879 |
| | Mokka Choung (toungya plantations). | 38 | 50 | 1879 |
| | Mokka Beeling ... ... | 24,242 | 1,287 | 1873 |
| | Thoonzai ... ... | 2,180 | 120 | 1879 |
| Hanthawaddy | Magayee ... ... | 2,782 | 1,386 | 1872 |
| | Kyetpyoogan ... ... | 683 | | 1868 |
| Toungoo ... | Yaynay (Sitang, west) ... | 5,760 | 273 | 1877 |
| | Pyoon Choung (Sitang, east) ... | 3,440 | 415 | 1877 |
| | TOTAL ... | 54,172 | 7,538 | |

The annual outlay (Rs. 139 for 1,000 acres) is very high; but, after carefully considering the matter in detail, I have come to the conclusion that it cannot at present be materially reduced. The outlay is particularly high in the Magayee and Kyetpyoogan plantations, parts of which are as yet full of high grass, rendering fire-protection difficult. Added to this, the shape of the Magayee plantation is most unfavourable, being a narrow belt about eight miles long.

**Selection of protected areas.**

190. Regarding the object with which these operations were undertaken in the blocks named, it should be explained that some of the smaller blocks are more plantations than forests. To this class belong Prome, Myodwin, Kyetpyoogan, and Magayee, and the toungya plantations at Gway-douk-tsan, on the Myoung choung, in the Minhla, Mokka, and Thoonzai forests.

Regarding the others, Choungzouk, Bwet, and Nyanlay were selected as instances of dry myin-wa forest. In forest of this description the annual jungle fires are particularly destructive. At the same time, the forest being open and the cover light, teak benefits largely by the exclusion of fire. Seedlings and shoots from underground stocks spring up, and not having any heavy cover to contend with, grow vigorously, benefiting by the greater moisture

kept in the ground through fire-protection. The Mokka Beeling and the Boben Choungwa forests, on the other hand, were selected as instances of moist forest on rich soil, stocked with tin-wa and kyathoung-wa. Here the bamboo benefits largely by protection from fire; it grows up more dense, and the heavier cover of the bamboo does not favour the increase of the growing stock of teak by the growth of seedlings and shoots from underground stocks. Blanks, however, are caused occasionally by the flowering of the bamboo and the falling of trees, and in such blanks young teak has a good chance. At the same time, the existing teak trees benefit by fire-protection, and teak plantations thrive well in forest thus protected. All these are hill forests. The Kangyee forest was selected for fire-protection being a forest on level ground and alluvial soil, with very little bamboo, where the conditions of the growth of teak are totally different from what they are in the other forests. Again, the forests selected for protection are situated under very different conditions as regards climate, from the moist climate of the Beeling to the comparatively dry climate of the Prome district. The remaining two blocks are situated in the Sitang valley, one near Toungoo and the other near the northern frontier.

191. The protection of a large number of distinct blocks is more difficult and expensive than would be the protection of a few large forest areas; but what has been stated will explain that, in the present case, it was necessary to undertake fire-protection in a number of separate blocks.

The protection of forests from fire is a new business in Burma. The methods that should be employed to attain success, and the work that must be done in order to employ fire-protection for increasing the growing stock of teak, are matters that must be studied under different conditions before operations can be extended on a large scale.

Howsoever much therefore we may wish to diminish the cost of forest management in Burma, none of the areas in which fire-protection has been undertaken can be given up. But except in special cases new blocks should not be taken in hand until more experience has been gained in the matter, and the area under protection should rather be extended by increasing the blocks already protected.

**Areas protected in Tenasserim.**

192. In the Tenasserim Circle the following areas were protected in 1880:

| Civil district. | Forest tract. | | Area protected in 1880. | Outlay in 1879-80. | Year when fire-protection commenced. |
|---|---|---|---|---|---|
| | | | Acres. | Rs. | |
| Salween ... | Beeling ... | Mainan-nway ... | 3,840 | 3 | 1878 |
| | | Maywine ... | 8,320 | 34 | 1877 |
| | Doomdamee | Beelakatgyee ... | 3,000 | ..... | 1880 |
| | | Oankangyee ... | 4,160 | 47 | 1877 |
| | Yoonzaleen | Wamoo ... | 1,920 | 10 | 1871 |
| | | Sinzway ... | 8,860 | 990 | 1871 |
| | | Kahecloo (dry portion) | 1,280 | 60 | 1878 |
| Amherst ... | Attaran ... | Dalee ... | 11 | 30 | 1878 |
| | | Kyoon Choung ... | 10,850 | 125 | 1880 |
| | | TOTAL ... | 42,241 | 1,299 | |

or Rs. 30 for 1,000 acres.

The protection of these forests is chiefly secured by enlisting the co-operation of the Karen inhabitants of the place, who in most cases are also employed in cultivating teak on toungyas cut by them inside the protected reserves. In the case of the Yoonzaleen forests, there is also the advantage that over large areas the custom prevails among the Karens to protect against fire the toungya grounds which are lying fallow. Thus the Wamoo reserve, above Papoon, is safe on two sides and requires no special protection here, and part of the boundary of the Sinzway and Kahecloo reserves adjoins bamboo forests, which are the toungya grounds of the Karens and which are regularly protected by them.

193. It will be noticed that in the case of the reserves here named the entire area is under protection, excepting the Dalee, Kaheeloo, and Doomdamee forests. For Kaheeloo that portion only is entered which is stocked with dry deciduous forest, and which, therefore, is exposed to jungle fires. The remainder being evergreen is safe against fire and requires no protection. In the Doomdamee, the Oankangyee block is the only one that can at present be protected against fire. The rest cannot be taken up until the extensive savannahs near the Doomdamee river have been converted into paddy-fields. In the Dalee forest protection may be extended. With this exception, therefore, any extension of fire-protection in the Tenasserim Circle must be by taking in hand additional areas; and it is contemplated to set apart an area in the Meplai forest of the Thoungyeen district for this purpose, and to take in hand the Nat-choung and Kyoon choung forests in the Attaran district. In all these cases, as well as in the case of the other Tenasserim reserves, it is part of the scheme that, simultaneously with the exclusion of fires, teak is planted in toungyas; indeed, in some cases, where there are no villages near the forest, fire-protection cannot be attempted unless people can be induced to settle in the forest, and to plant teak in the toungyas cut to provide for their food.

The protection of the areas in hand at present in the two circles costs—

| | Acres. | Annual cost. |
|---|---|---|
| | | Rs. |
| In Pegu ... ... ... ... | 54,172 | 7,538 |
| In Tenasserim ... ... ... ... | 42,241 | 1,299 |
| TOTAL ... | 96,413 | 8,837 |

or at the rate of Rs. 91 per 1,000 acres. The cost, however, will diminish as larger areas are taken in hand, and I feel sure that eventually it will be possible to protect 200,000 acres at a cost of Rs. 15,000 per annum.

### Cultural operations.

194. Fire-protection, though it improves the productiveness of the forests generally, and though in certain classes of forest it tends directly to increase the growing stock of teak, is not sufficient to accomplish all that is required. Teak must be sown and planted artificially on a very large scale, in order to increase its proportion to such an extent as to enable the forests to contribute permanently a large portion of the teak timber consumed in the Province and exported.

The cultural operations hitherto undertaken to attain this object have been of three classes, which, for convenience sake, may be designated as—(1) regular plantations, (2) toungya plantations, and (3) other works.

### Regular plantations.

195. The oldest of these were commenced in 1856 and 1857. They were experimental and on a small scale, the chief object being to afford an opportunity for studying the growth of teak.

Near the head of the Winyeo valley in the Attaran district, the Thingan-neen-noung plantation was made in 1856 on magnificent soil and in a moist forcing climate. Its present area is 16 acres, and the dominant trees

2 feet in girth and upwards, number 957, which is at the rate of 60 trees per acre. The following measurements were taken by Mr. T. H. Aplin, Assistant Conservator of Forests, in December 1880, when the plantation was 24½ years old. The girth of all trees in girth 2 feet and upwards was measured at 5 or 6 feet from the ground, and gave the following results:

| | | | | |
|---|---|---|---|---|
| From 2 feet | to less than | 2 feet 6 inches | ... | 335 trees. |
| 2 do. 6 inches | ditto | 3 do. | ... | 232 do. |
| 3 do. | ditto | 3 do. 6 inches | ... | 198 do. |
| 3 do. 6 inches | ditto | 4 do. | ... | 129 do. |
| 4 do. | ditto | 4 do. 6 inches | ... | 46 do. |
| 4 do. 6 inches | ditto | 5 do. | ... | 10 do. |
| 5 do. | ditto | 5 do. 6 inches | ... | 6 do. |
| | 5 feet 10 inches | | ... | 1 tree. |

Thus there are 567 trees below 3 feet, 373 trees between 3 feet and 4 feet 6 inches, and 17 trees above 4 feet 6 inches. The height of stem to the first fork or large branch was measured of 45 trees. The shortest stem was 31 feet, the tallest 66 feet, while the mean was 49 feet. The total height of the trees is not given, but may be assumed to be 80 feet on an average. The plantation is surrounded by evergreen forest, which has encroached upon the plantation, so that a large number of the teak trees are dominated by trees of other kinds.

The dimensions attained by these trees are similar to those attained by trees of the same age in the Nilambur plantation, Malabar. The following figures, omitting fractions, are taken from paragraphs 19 to 22 of Colonel Beddome's Report of 1878:

| Year when formed. | Age. | Soil. | Average | | Maximum girth. |
|---|---|---|---|---|---|
| | | | Height. | Girth. | |
| | Years. | | Ft. | Ft. In. | Ft. In. |
| 1851 ... ... | 26 | Alluvial ... | 80 | 2 7 | 5 2 |
| 1851 ... ... | 26 | Laterite ... | 60 | 2 3 | ..... |
| 1852 ... ... | 25 | Alluvial ... | 75 | 2 1 | ..... |
| 1852 ... ... | 25 | Laterite .. | 50 | 1 9 | ..... |
| 1853 ... ... | 24 | Alluvial .. | 65 | 2 3 | ..... |
| 1854 ... ... | 23 | Ditto ... | ..... | 2 1 | 4 6 |

Many of the trees of the 1854 plantation were 100 feet high. The number of trees per acre of these blocks is not stated, but it is probable that the number was much larger than at Thingan-neen-noung. The plantation of 1848 (31 years old) contained 156 and that of 1858 (19 years old) 270 trees per acre (paragraph 90 of Report). The result of the closer growth shows itself in a somewhat smaller girth at Nilambur.

Fifty miles above Moulmein, on the east bank of the Salween river, on poor sandy soil, teak was planted near Shwaygoon; present area about 5 acres. The trees are crowded, and the growth has been slow; but the border trees have attained an average girth of 36 inches and a total height of 65 feet. Trees planted in an avenue at the same time are 60 feet high on an average, and have a mean girth of 49 inches, the largest measuring 62 inches; but the stems are badly shaped and irregularly grown.

On dry rocky hills near the Irawaddy river, below Prome, a plantation of 73 acres was formed in 1857, and in 1880 the dominant trees averaged at the foot of the hill, on deep soil, 36 inches in girth and 77 feet in height. On the hill the average girth is 24 inches and the average height 61 feet.

196. The cost of these earlier experimental plantations has been exceedingly high; the two on the Moulmein side, made before the Forest Department there was amalgamated with that of Pegu, having been Rs. 1,500 and Rs. 757 per acre, respectively, while Prome had cost to the same date (31st March 1880) Rs. 123 per acre. But the object has been attained, and it has been proved that in 24 years teak will attain, on rich soil and in a forcing climate, a girth of 3 feet; on less favourable soil and in a drier climate, a girth of 2 feet.

197. In 1859 a small plantation was established in the immediate vicinity of Rangoon. The soil is laterite and is unfavourable for the growth of teak. The trees are now 21 years old, and the dominant trees are 36 to 60 feet high, with a girth of from 14 to 24 inches. Teak trees planted in 1858, on similar soil in a garden in cantonments, have short badly-shaped stems, but have attained a girth of from 27 to 55 inches. In the same garden the following trees were planted in the same year, and had attained girths as follow when measured in April 1880:

| | | Girth. |
|---|---|---|
| 1. | *Briedelia retusa* (Tseikchee) ... ... ... | 55 inches. |
| 2. | *Shorea robusta*: Sâl (from Bengal) ... ... | 52 do. |
| 3. | Ditto ditto ... ... ... | 53 do. |
| 4. | *Swietenia Mahagoni* (Mahogany) ... ... | 34 do. |
| 5. | *Sterculia scaphigera* ... ... ... | 58 do. |
| 6. | *Casuarina equisetifolia* ... ... ... | 52 do. |
| 7. | *Pterospermum acerifolium* (Tounpetwoon) ... ... | 65 do. |
| 8. | *Hopea odorata* (Thingan) ... ... ... | 40 do. |

On this soil (laterite) these trees had attained a much larger size than teak.

Another small plantation of 10 acres made between 1862 and 1864 at Myodwin in the Tharawaddy district, and carefully protected from fire, shows that in this locality, on good average soil, teak has attained in 16 to 18 years from 25 to 30 inches in girth and from 62 to 72 feet in height.

A small area planted in 1865 near Kimpadee, in the Magayee district, on similar soil, but burnt annually, shows only 16 inches girth and 48 feet height as the result of 15 years' growth.

### Pyoon Choung.

198. Commencing with 1866 a number of plantations on a larger scale were made. The oldest was the Pyoon Choung plantation, on a feeder of the Thouk-ye-gat river, near Toungoo. It was planted between 1866 and 1870, and the total area is 696 acres, the outlay having been Rs. 35 per acre. A large portion of the area planted in 1870, however, is imperfectly stocked. In the portions well stocked, and planted between 1866 and 1869, the trees are from 20 to 26 inches in girth and from 50 to 72 feet high. In rapidity of growth this plantation surpasses all others of its age.

### Kwaymakaing.

199. In 1867 and 1869, 144 acres were planted at Kwaymakaing on the banks of the Beeling river in the Tharawaddy district. The cost up to date has been Rs. 110 per acre; and though in places the bamboos have killed out the teak, the area is upon the whole well stocked. The girth of the dominant trees varies, according to the locality, from 15 to 22 inches, and they are from 40 to 60 feet high.

### Boben Choungwa.

200. In 1868 and 1870, 340 acres were planted in the Boben forest in Tharawaddy. Bamboos have in places got the upper hand, but the plantation is sufficiently stocked with teak, and the rate of growth has been good. The dominant trees of 1868 are from 54 to 70 feet high on an average, and their mean girth varies from 22 to 26 inches.

### Kyetpyoogan.

201. From 1869 to 1871, 683 acres were planted at Kyetpyoogan, 26 miles north of Rangoon. This plantation, though made with great care, under excellent supervision, has not been successful. A large portion is badly stocked, and the whole concern has suffered much from fire. This plantation was made because at that time it was thought that the best plan would be to plant teak in the vicinity of Rangoon, instead of selecting sites in the forests. This supposition has not been borne out by the result. The rate of growth has been slow, and the trees are not well shaped; while the outlay has been as high as Rs. 112 per acre. In the better stocked places dominant trees are 12 to 15 inches in girth and 30 to 40 feet high. But these places occupy only a small proportion of the total area. With continued fire-protection, the trees will doubtless eventually yield good timber, though the timber is never likely to be long and well shaped. So much, however, is clear that teak must be planted, not near Rangoon, but where it has its home and thrives best, in the forests.

### Magayee.

202. At Magayee 1,347 acres were planted at a cost of Rs. 85 per acre between 1872 and 1879. The planting of the earlier years was on unfavourable soil, but the blocks of 1876 and 1877 are near the foot of the hills, and are all that can be desired.

### Rate of growth.

203. The great result obtained from these plantations is that we are now in a position to form definite conclusions, up to a certain age, regarding the rate of growth of teak in Burma, grown under different circumstances and in different localities, and that we have gained experience in the selection of sites for planting.

The result as regards the rate of growth of dominant trees may be seen from the following figures:

| | | Age. | Mean girth (breast high) in inches. | Total height in feet. |
|---|---|---|---|---|
| | | Years. | | |
| 1. | Thingan-neen-noung ... ... | 24 | 30 to 48 | 80 |
| 2. | Shwaygoon . ... ... | 24 | 24 | 65 |
| 3. | Prome ... level ground ... | 23 | 36 | 77 |
| | Prome ... on hill ... | 23 | 24 | 61 |
| 4. | Myodwin ... ... ... | 16 to 18 | 25 to 30 | 62 to 72 |
| 5. | Pyoon Choung ... ... | 11 to 14 | 20 to 26 | 50 to 72 |
| 6. | Kwaymakaing ... ... | 11 to 13 | 15 to 22 | 40 to 60 |
| 7. | Choungwa ... ... | 12 | 22 to 26 | 54 to 70 |

These figures justify the conclusion that teak in Burma, planted on fairly good soil and protected from fire, will attain a girth of 18 inches in 15 and a girth of 36 inches in 32 years. From this we may safely conclude that, under similar circumstances, the tree will attain 54 inches in 52 and 72 inches in 80 years.

It will now be well to compare this result with the estimates hitherto framed of the rate of growth of teak in the natural forests of Burma:

| Girth, in inches. | Age of tree: Estimate of | | |
|---|---|---|---|
| | 1860. | 1868. | 1880. |
| 18 | 10 | 19 | 15 |
| 36 | 22 | 46 | 32 |
| 54 | 37 | 88 | 52 |
| 72 | 62 | 160 | 80 |

The estimate of 1860 was based chiefly upon the measurement of trees of known age grown in gardens, as detailed in pages 144 and 145 of the Report on the Attaran forests. In 1860 it was considered doubtful whether the concentric rings, which are visible in the wood of teak, corresponded to the annual increment of the tree. Subsequently, the examination of the wood of teak trees at the Botanic Gardens, Calcutta, which were blown down by the cyclone of 1864, and the age of which was known, as well as the examination of trees 11 years old in the older plantations of Burma, showed that the concentric rings could be regarded as annual, and accordingly the estimate of 1868 was based upon the examination by Dr. Schlich of the butt ends of 50 logs from the Tharawaddy forests. These trees, however, it must be remembered, had grown up under the influence of regular annual jungle fires, which impoverish the soil and make it dry and barren; while the present estimate presupposes immunity from fire, and consequently a soil kept moist and becoming richer and more fertile every year. There is nothing unreasonable in the supposition that a teak tree growing up in a forest protected from fire will attain a girth of 6 feet in 80 years, while 160 years are required to attain the same size in a forest which is burnt annually. The present estimate justifies the assumption that the present plantations, and others which may be formed on a similar plan, will, at the age of 90 years, carry, in addition to bamboos and other trees, 60 mature teak trees per acre, each yielding 75 cubic feet of timber. Thus, if thinnings are excluded from the calculation, the mean annual yield of successful plantations, continuously protected against fire, may be estimated at 50 cubic feet per acre.

**Outlay on plantations.**

204. The total area planted in the Pegu and Tenasserim circles to the 31st March 1880 was 3,389 acres, upon which Rs. 3,00,689 had been expended, or at an average rate of Rs. 88 per acre. These plantations, when mature, may be expected to furnish an annual yield, excluding thinnings, of 3,300 tons, and some of them will yield valuable thinnings long before they attain maturity. In nearly all the larger plantations the teak was sown with crops of cotton, til seed, and vegetables raised for sale by the coolies employed. This system was carried out with considerable success in the Pyoon Choung plantation near Toungoo, and hence the moderate cost (Rs. 35 per acre) of that undertaking. By choosing a favourable locality, with facilities for the sale of the produce raised by the cultivators, and by insisting on a complete burning of the forest cleared for the plantation, so as to diminish subsequent weedings, it ought, with the experience gained, to be possible to reduce the cost of such plantations to Rs. 40 per acre on an average.

**Future plans.**

205. It will be proposed in the present Report that an area of 200 acres be annually planted up on this system, and the question is which locality should be selected? Now that ample experience has been gained regarding the result and cost of teak planting in different parts of the Province, it will be best to concentrate these operations at one place. We are now in the favourable position that plantations have been made in nearly all parts of the Province, and that sufficient experience has been gained to enable us to select the most suitable locality. The chief points to be kept in view must be—*first*, rapid growth, good quality, and regular shape of the timber produced on the plantation; *second*, facilities for export and for the profitable sale of the mature timber and thinnings; *third*, sufficient labour at moderate rates; *fourth*, a locality not too feverish or otherwise unhealthy.

206. In Tenasserim labour is too scarce and too expensive. In this circle, therefore, toungya teak plantations are the only feasible plan. In Pegu the Prome forests are out of the question at present; they are too dry, and the growth of teak would be too slow, though the excellent shape and quality of the timber would, to some extent, compensate for the slow growth. In the Tharawaddy district, Boben Choungwa and Kwaymakaing have answered well as regards rate of growth; and the shape and quality of the timber in the

surrounding forest is all that could be desired. But these places have proved much too feverish for such undertakings. At Myodwin, outside the hills, teak has done remarkably well. The low ground between it and the Boben stream is now, I understand, being cleared rapidly by Karen villages, but on the high ground, outside the eng forest, a large area of uncleared land remains, and the plantation might perhaps be extended in this direction. The place is feverish, but less so than the hills, and the suggestion merits consideration.

207. In the Rangoon district, Magayee has proved extremely unhealthy; and though it is close to the railway, the nearest railway station is distant and difficult of access. Hence labour is scarce, and it has been decided to discontinue planting there for the present. As soon as a convenient railway station is established at Pahlun road, the advantages of its position will be considerable. Thinnings and timber can then be sent down to Rangoon both by train and by river. The place will be more readily accessible, the labour difficulty will probably diminish, and the plantation may then be continued, either contiguous to the present locality, or further south at another place in the Hline Yoma reserve.

In the Toungoo district the best place is certainly the Pyoon Choung, eight miles east of Toungoo. For facility of supervision there are few places like it; the plantation has been made at less cost than any other; there is every facility for export, and the teak has grown very rapidly. Moreover, the shape and quality of the timber produced in the natural forest around are good.

**Extension of Pyoon Choung plantation proposed.**

208. I would suggest that the existing Pyoon Choung plantation should be extended as far as suitable land may be available, stretches of natural forest being left standing between the planted blocks. Higher up the stream there are villages, and the area available in the vicinity of this stream will probably be limited. No land save such as is really suitable should be planted with teak, and when no more suitable land is available near the Pyoon Choung, other places in the Thouk-ye-gat or Kannee forest should be selected. By the time that all available land in the immediate vicinity of Toungoo is exhausted, other eligible localities near the Sitang river may have been found, or, if not, Myodwin, or the vicinity of Magayee, may then be taken up.

**Toungya plantations.**

209. After examining the Prome forests in March and April 1856, I recorded the following suggestion in my Report for that year:

In the Prome district, on dry hills near the Northern Nawing, the burning of the trees and shrubs for toungya cultivation does not create a mass of low dense jungle, as in the other parts of Pegu. There, on the contrary, the fertilizing influence of the ashes has another effect. An unusual abundance of young trees is found on deserted toungyas, among which there is generally a due proportion of teak. Hence a deserted toungya in those places may, with some care, be converted into a very valuable nursery for teak; and an attempt has been made to give practical effect to this idea by encouraging the cultivators of toungyas in that district *to sow teak in regular rows with their rice and cotton.* The teak, as it generally germinates after several months, will not impede the growth of their crops, and will greatly profit, both by the fertilizing effect of the ashes, and also by the clear ground during the first year after the harvest has been removed, which may permit it to make such progress as to enable it to compete successfully with other trees and bushes. This system, if it should succeed, may perhaps even be extended to toungyas in other districts, where, however, a clearing of the dense jungle on both sides of the rows of young teak will be necessary.

Instructions were at the same time issued to the Foresters (Goungways) in charge of the several forest districts to plant teak in their toungyas, and this has been the origin of small groves and groups of teak trees in several districts planted about that period. In August 1858, on a tour through the Attaran forests, the plan was discussed with the Karens in that district. They offered to sow teak with paddy in their toungyas, provided the trees thus planted were regarded as their property. In paragraph 39 of the Report for 1863-64 an account is given of the attempts made by Major (then Lieutenant) Seaton, when in charge of the Tharawaddy Forest Division, to induce the Karens

to plant teak in their toungyas. They were most unwilling to undertake this work. They admitted, however, that if their own toungyas were examined, a few teak trees would be sure to be found to have died from the effects of the fire, and that they were ready to expiate their offence by planting up a toungya with teak. In the Thoonzai forest several hundred teak trees had actually been raised by Tsokay Pala, who had been found guilty of a breach of the forest rules, rather than be punished under the rules. Small plantations were made under similar circumstances in the Thanapo and Mokka forests.

**Commencement made in 1868.**

210. No real progress was, however, made in this matter until Major Seaton, when Conservator of Forests, induced the Karens of the Thoonzai and Beeling forests to plant teak in their toungyas at certain rates of remuneration, which were paid to them by the Department. This was in 1868, and since then a total area of 2,515 acres has been planted at an aggregate cost of Rs. 24,932, or Rs. 9-14 an acre.

**Terms of payment.**

211. The conditions under which these plantations are now generally made are as follows: The plants are counted after the close of the rains, and paid for at the rate of Rs. 10 per 1,000 in Pegu, and Rs. 8 per 1,000 in Tenasserim. Plants in excess of 1,000 per acre are not paid for. In Pegu the Karens collect the seed themselves, while in Tenasserim the seed is provided by the Department. In addition to this, the capitation and toungya taxes are paid for them. As the toungya plantations are all in fire-protected forests, it is of the utmost importance that when the toungyas are fired the fire shall not spread into the forest. Hence they engage to fire their toungyas in regular order, all men assisting in preventing the spread of the fire. The cultivators generally also undertake to assist in protecting the reserve against fires entering it from the outside.

**Treatment.**

212. The teak is generally from six to twelve inches high at the end of the rains, and the plants require to be kept clear of weeds and bamboo shoots during the first three years; after which, if the weeding has been efficient, the trees are generally from 10 to 15 feet high, and are able to hold their own against weeds, grass, and trees of other kinds, except bamboos of the faster-growing species. The subsequent clearing of the plants is paid for separately, and in many cases labourers from elsewhere must be procured to do this part of the work.

The teak is generally planted at equal distances six feet apart, and under this arrangement there ought to be 1,210 plants to the acre. But the number of plants which survive is always less; hence the low average rate paid.

Experiments have been made to plant a mixture of teak and other trees, and to plant the teak in narrow bands 30 feet apart, each band consisting of two or eight lines of teak plants six feet apart. Nothing, however, has hitherto answered so well as the planting of teak pure at six feet by six feet, and the only other arrangement which may in some instances be preferable is to plant lines ten or twelve feet apart, and three or four feet within the lines.

The last-named arrangement I have recommended for the Yoonzaleen forests, in order to facilitate control and the clearing of the plants. In these forests most of the plantations have been made in forest of a peculiar kind of bamboo, called Tabendein (*Bambusa villosula*, Kurz), the stems of which come up singly (whence the Burmese name) and not in clumps, as other species. This bamboo, which is common all over the hills between the Sitang and Salween rivers, covers the ground to the exclusion of everything else; and after having been cut and burnt for toungya cultivation, it produces shoots in the second monsoon after burning, up to 20 feet high, or nearly one-half the height which it attains when mature. At the end of the second rains, the teak seedlings sown on toungyas in this

forest have attained a height of ten feet and are generally much smaller. Hence, unless the bamboo shoots in the vicinity of the teak are cut down wholesale, the latter is smothered. When plants are sown at a uniform distance of six feet, the result invariably is that the plants which have survived are scattered about in an irregular fashion, so that the work of clearing them of bamboos is difficult and almost impossible to control; whereas, if the lines of teak are 12 feet apart, and the plants within the lines are at a distance of three feet, we have the same number of plants per acre, but their distribution facilitates clearing and makes control of the work done along the cleared lines an easy matter. Even if half the plants fail, the lines remain complete, on account of the close planting within the lines. There may be places in Pegu where hereafter the system of planting in lines will be found preferable.

**Cultivators should be made responsible for the clearing of plantations.**

213. The advantages of these toungya teak plantations are now thoroughly appreciated by the Karens in most districts where they have been attempted, and under proper management there ought in future to be no difficulty in planting up large areas annually. In some forest districts the desire among the Karens to plant is so great that the Forest Department may now commence to make its own conditions, and the chief improvement proposed to be introduced in the arrangements is not to permit any toungya to be cut for planting teak, unless the people undertake the responsibility of clearing the plants continuously during the first three years after planting. Under this arrangement they would of course be paid separately for clearing, but as far as possible no persons should be permitted in future to cut fresh toungyas who had not in their previous operations fulfilled the conditions of their agreement with regard to clearing. This change cannot of course be made suddenly, but should be introduced gradually.

Another improvement of the present system, which may eventually be feasible, is that the plants paid for should be counted, not at the end of the first rains, but at the end of the second season, after they have been cleared for the first time. There is, however, this disadvantage, that toungyas, though easily accessible after the first rains in December or January, during the second monsoon get completely covered with a dense growth of bamboos, herbs, and coppice shoots. The counting and examination of the plants in the second winter after planting would, therefore, unless planted in lines and perfectly cleared, be more difficult, more expensive, and less reliable than during the first winter. Hence this suggestion is not proposed for adoption at present.

**Teak overtopped by bamboos.**

214. The great difficulty in toungya plantations is that the bamboos are apt to overtop and to kill out the teak. If properly taken care of and weeded, teak grows in these plantations from ten feet to fifteen feet high in three years, but the bamboo clumps, if not killed, send forth, four or five years after burning, shoots 40 to 60 feet long. At that time teak is from 15 to 25 feet high. The bamboo shoots grow up all at once in dense masses, the teak suffers, and is either kept back by the cover of the bamboos, or forced up into long thin weak stems, or entirely suppressed. If rain falls early in the season and the burn is not complete, the bamboos recover sooner and their shoots are produced earlier and are more vigorous. When firing their toungyas, toungya cultivators ordinarily rather avoid killing the bamboo clumps, for bamboo is the most easily cut and most profitable forest for toungya cultivation. But where teak is planted, they do not expect to cut toungyas again in the same place; and if they are made responsible for clearing the plantation, they will take good care to make the burn as complete as possible.

**Extent of contemplated operations.**

215. It will be proposed in this Report that a large area, upwards of 1,000 acres. of toungya teak plantation be made annually. Like all other cultural operations, these must only be undertaken in reserved forests protected

from fire, so as to obviate the necessity of protecting a large number of detached blocks. This means the employment of at least 330 toungya-cutters, with their families, on these plantations. Counting 15 toungya-cutters to one tay or hamlet, it means the location of 22 tays with an aggregate population of 1,200 to 1,800 souls in the fire-protected forests, or in their vicinity. In ten years these people will cut an aggregate area of 10,000 acres, and care must be taken to have a sufficient area of suitable land available and conveniently situated, where they can raise their paddy with the teak, for the continuance of these operations and for their maintenance.

The area planted in 1879-80 was 321 acres, and it is believed that it will at once be possible to plant 300 acres annually in the Pegu Circle and 200 in the Tenasserim Circle; total 500 acres, to be extended gradually to the full area contemplated, 1,000 acres a year.

**Estimated outlay.**

216. The area of toungya plantations made to the 31st March 1880 and the amount expended upon the same are as follows:

| | Area. | Total cost. | Cost per acre. |
|---|---|---|---|
| | Acres. | Rs. | Rs. As. |
| Pegu Circle ... ... ... | 1,950 | 20,239 | 10 6 |
| Tenasserim ditto ... ... | 565 | 4,693 | 8 4 |
| TOTAL ... | 2,515 | 24,932 | 9 14 |

It will not in future be possible to plant at so low a rate, because more must be paid for the subsequent clearing of the plantations.

A considerable extent of the area operated upon, particularly in the Tenasserim Circle, is imperfectly stocked, because the subsequent clearing had been neglected. The estimate of the future cost of these operations per acre may approximately be put down as follows:

| | Rs. As. |
|---|---|
| Planting, including cost of seed ... ... ... | 7 0 |
| Taxes ... ... ... ... ... | 1 5 |
| Clearing three years (Rs. 2-8 + 2 + 1) ... ... ... | 5 8 |
| Sundries ... ... ... ... ... | 0 3 |
| TOTAL ... | 14 0 |

The annual outlay for planting and clearing 1,000 acres will, therefore, amount to Rs. 14,000.

A portion of the existing toungya plantations is not well stocked, and the area cannot therefore be expected to yield the full outturn of 50 cubic feet per annum per acre estimated in the case of regular plantations. However, the 2,515 acres planted may be expected, when mature, to furnish an annual yield of, say, 1,000 tons of teak timber, and there is no reason why the toungya teak plantations which will in future be made with greater care, particularly as regards clearing, should not yield as much as the regular plantations.

**Other works.**

217. In the special part of this Report a full account is given of the different operations undertaken by Mr. Ribbentrop in the Mokka Beeling, Kangyee, and Nyanlay forests of the Pegu Circle, with the view of increasing the proportion of teak by sowing in favourable localities. The result in these and other forests is that, on the 31st March 1879, the following areas had been operated upon:

A.—Bands, 100 feet wide, cut and burnt in bamboo forests—Mokka Beeling, 1877, 12 acres; Nyanlay, 48; Bwet, 81 acres: total 141 acres.

B.—Dibbling in seed where the bamboo had flowered, or in forest without bamboo under trees girdled, so as to admit light—

Choungzouk: about 300 acres in 1877 and 1879, under myin-wa and where that bamboo had flowered.

Bwet: 100 acres in 1877 and 1879, where myin-wa had flowered.

Nyanlay: 50 acres, where myin-wa had flowered, in 1878.

Kangyee: 600 acres in 1878, 25 acres in 1879; in tree forest without bamboo, a proportion of the trees having been girdled.

Mokka Beeling: in tin-wa forest after flowering; 100 acres in 1877 and 400 acres in 1878; in forest without bamboo, after girdling a proportion of the trees, 10 acres in 1876: total 510 acres.

These operations have thus extended over an aggregate area of 1,726 acres.

The great advantage of the bands cleared and sown in bamboo forest is that the bamboo is killed effectively, and that the ground is kept moist by the neighbouring forest. The success of these bands, which were commenced by Mr. Wild in the Mokka Beeling forest, is remarkable, and if the cost can be reduced the plan should be steadily continued. These bands, if properly made, may be classed with the best plantations as regards their future yield. Hitherto the cost of these bands has been as high as that of regular plantations.

The plan of dibbling in seed is excellent in dry myin-wa forest and in tree forest without bamboos. But the difficulty is, that it must be done in numerous plots scattered over large areas, and that efficient control is not easy to apply. The work should be continued where good supervision can be given to it. The moderate cost (estimated to be only Rs. 5 per acre) is its great recommendation. Many thousand acres of forest may by this operation be converted into rich teak localities, which will eventually largely increase the yield of the forests. For the present it is proposed to spend Rs. 3,000 per annum on works of this description. Under this head should be briefly mentioned the work that has been done in the way of freeing teak trees from creepers, a most important operation, which was commenced in 1856 and has been continued in some forest districts ever since. Upon the whole, I have noticed with satisfaction during my late tour that in many forest districts the cutting of creepers had been well attended to, and in some cases it was gratifying to notice the comparative scarcity of creepers on teak trees in forests which were formerly infested with this pest to such an extent as seriously to interfere with the growth and shape of the trees. The cutting of creepers on teak trees should, as has hitherto been the case, be regarded as the special duty of the Forester in charge of the forest. It should be distinctly understood that in the vicinity of roads and pathways no creepers on teak trees must be found; and after this rule has been successfully enforced for some time, a further step may be taken, and the cutting of creepers in the interior of the forest, block by block, may be insisted upon.

Other works are the cutting, lopping, or girdling of other trees and the cutting of bamboos, where they interfere with the growth of young teak. In this respect also much has been done, and the effect upon the growth of young teak has been most beneficial. These operations—the cutting of creepers and the setting free of young teak where it is overtopped—should be actively pushed on whenever labour and supervision are available, in connection with girdling operations or with other works in the forest.

**Future operations.**

218. Recapitulating the work of special protection and improvement proposed to be done, the annual area to be operated upon and the amount to be expended will stand as follows:

| | | | Rs. |
|---|---|---|---|
| Fire-protection | 200,000 acres, | at Rs. 75 for 1,000 acres | 15,000 |
| Regular plantations | 200 do., | at Rs. 40 per acre | 8,000 |
| Toungya ditto | 1,000 do., | at Rs. 14 do. | 14,000 |
| Other works | ... ... | ... | 8,000 |
| | | TOTAL ... | 45,000 |

The full area cannot be protected against fire from the beginning, nor can the whole area be planted for some time to come. These works must be allowed to grow gradually; but ample experience having now been gained regarding the localities to be selected and the methods to be followed, the only difficulty that remains is that of procuring labour at moderate rates. Nor will it be possible at once to reduce the rates to those here stated; this also must be effected gradually.

**Increased yield expected from plantations.**

219. It has been explained that through the cultural operations already undertaken (up to the 31st March 1880) the future yield of the forests will probably be increased as follows:

| | | | | Tons. |
|---|---|---|---|---|
| Regular plantations, | 3,389 acres, | expected to yield | ... | 3,300 |
| Toungya ditto, | 2,515 | ditto | ditto | 1,000 |
| TOTAL ... | 5,904 | ditto | ditto | 4,300 |

This yield will of course not be attained until the plantations have attained maturity.

In addition to this, there are the miscellaneous operations in the forest on 1,726 acres; but regarding the yield of this area no estimate can be framed.

The cultural operations proposed to be undertaken in future may be expected to increase the prospective yield in the following manner:

| | | | | Rs. | | Tons. |
|---|---|---|---|---|---|---|
| Regular plantations, | 200 acres, | expected to cost | ... | 8,000, | to yield ... | 200 |
| Toungya ditto, | 1,000 | ditto | ditto | ... 14,000, | do. ... | 800 |
| TOTAL . | 1,200 | ditto | ditto | ... 22,000, | do. ... | 1,000 |

Thus the operations of each year may reasonably be expected to increase the annual future yield of the Burma forests by 1,000 tons; and the operations, if continued during a period of 40 years, will have added 40,000 tons to the future annual yield.

**From fire-protection and other works.**

220. But this is not all: the fire-protection combined with the other works of improvement may be expected to add large quantities to the annual yield of these forests, though it will not be possible to estimate the amount of these additions. The annual outlay on improvements, as here estimated, will consist of two main items: Rs. 23,000 for fire-protection and cultural operations in the forests, and Rs. 22,000 for plantations. It is most likely that the beneficial effect of increasing the growth of teak in the forests, which will result from the former, will be many times greater than that which will result from the plantations. The difficulty is that the good effect of those operations cannot be measured and expressed in figures in the same manner as the effect of plantations. Moreover, it is an essential point in the arrangement of both toungya plantations and regular plantations that the areas planted occupy narrow belts surrounded by other forest. Therefore, as the teak in the plantations attains maturity, it will spread from self-sown seed into the neighbouring forest, and the result will be a larger area of teak-producing forest. This advantage must not, however, be expected when, as at Thingan-neen-noung, the plantation is surrounded by evergreen forest which encroaches upon the teak and does not permit its spread by self-sown seedlings.

**Regular plantations why continued.**

221. Two questions arise in regard to plantations which may conveniently be discussed in this place.

It will be noticed that, while an outlay of Rs. 40 on regular plantations is estimated to ensure an annual yield in the future of 50 cubic feet, the same

result can be obtained by an outlay of Rs. 17-8 on toungya plantations. Why, it may be asked, should, under these circumstances, the efforts of forest officers not be confined to toungya plantations, which are more economical? The reason is that regular plantations have certain advantages which justify the larger outlay. The localities are selected with special regard to the conditions most favourable for the development of the teak tree, the facilities for supervising the work, and the export of the timber. In the case of toungya plantations, on the other hand, the selection of the localities must to a great extent be left to the Karens. The result is that toungya plantations are more scattered, the development of the teak is less uniformly good, supervision is less complete, and in the end, when the forest comes to be worked, the extraction of timber will be more expensive. A most important point, which should always be kept prominently in view in these works of improvement, is to diminish the future cost of extracting the timber from the forests. As a rule, therefore, plantations should be made in the immediate vicinity of a stream which admits of floating, and this will not always be possible in the case of toungya plantations. Hence it is only prudent, for the present, to continue both classes of operations.

**Are regular plantations financially justified?**

222. The second question is whether the outlay of Rs. 40 per acre on account of regular plantations is justified by the results expected? To this question no definite reply can at present be given, as it is not possible to make a reliable forecast of the quantity of timber which will eventually stand on the ground, of the rate at which this timber will be sold, and of the revenue that will be realized from thinnings.

The cost of planting, including weeding and clearing, may, as already explained, be estimated for the future at Rs. 40 per acre, which, at compound interest of 4 per cent. at the end of 90 years, at the time when the trees are expected to be fit for cutting, will represent an outlay of Rs. 1,365. At that time it is assumed that the plantation will be stocked on an average with 60 mature teak trees per acre, in addition to bamboos and other trees, each containing 75 cubic feet of marketable timber, or a total of 4,500 cubic feet. It is of course quite out of the question to estimate the value which this crop will have at that time, but it is probable that it will suffice to cover the outlay, even with the addition of compound interest at 4 per cent. Indeed, there seems good reason to hope that the thininngs, which will commence to yield revenue at an age of 40 years, will repay the original outlay with interest long before the crop has attained maturity.

**Conclusion.**

223. As far, therefore, as we can judge at present, the proposals here submitted are sound, and they should be steadily carried out. Experience must show whether these cultural operations should hereafter be extended on a larger scale. The scale at present proposed is moderate, and it will not be difficult afterwards to extend operations largely, if such should appear expedient.

At all events, what has been proposed in the present Report is in the right direction, and will go far towards bringing these forests into such a condition as to enable them to produce a large proportion of the teak timber which will be required for local consumption and for export.

# CHAPTER VI.

## WORKING OF THE FORESTS.

224. The remarks of this Chapter relate to teak only. The demand for none of the other kinds is at present sufficiently large to require a plan of operations. Some of them, such as thingan and padouk, are, it is true, getting scarce; but in the case of these and other timbers which may demand special protection, all that is required at present is to prohibit the cutting of trees below a certain standard size, to prohibit the cutting of certain kinds in certain localities, or to prohibit it altogether, except on Government account.

For teak it will be convenient to maintain a girth of six feet, measured at six feet from the ground, as the minimum size of the trees to be girdled. Exceptions must of course be made where circumstances may require such exceptions. Thus on hot and dry ridges teak does not reach a girth of six feet, and it attains maturity at a less size. On the other hand, in places favourable for the growth of teak, it may be desirable to allow trees to attain a larger girth than six feet, so as to yield timber of greater value.

225. Statement II. appended to this Report exhibits the teak trees girdled on account of Government, and the teak timber brought from the forests of British Burma, during the 23 years from 1856-57 to 1878-79. It will be noticed that during this period the total outturn has been 802,111 tons, which is at the rate of 34,800 tons per annum. This, however, includes timber brought from certain forests which are at present in private hands, viz.,—

| | | |
|---|---|---|
| | 22,698 tons from the Pandaw forests. | |
| | 30,064 | ditto Attaran forests. |
| TOTAL ... | 52,762 tons. | |

leaving 749,349 tons as the outturn of the Government forests, which is at the rate of 32,500 tons per annum on an average.

It will also be remembered that the total mean consumption of teak timber produced in and exported from Burma during the last five years amounted to 227,149 tons per annum, the larger portion of which is brought from forests beyond the frontier. As explained in another part of the Report, it is intended that the forests in British territory shall eventually, when the supply from foreign territory has diminished, furnish as large a proportion as possible of the quantity annually required; and to enable them to do so, it is proposed to plant a large area of teak annually. As regards the yield of the natural forests, it will be remembered that the policy is to demarcate a sufficient area of the best teak-producing tracts, and to improve their productiveness by planting and otherwise.

### Distinction between demarcated reserves and forests excluded.

226. Therefore, as regards working, we must distinguish between the demarcated reserves and the forests excluded from them. Upon the productiveness of the demarcated reserves the future supply of teak timber will mainly depend, and these areas must, therefore, at present be worked with the greatest caution. As the area stocked with teak by means of the cultural operations now in progress increases, the number of trees cut annually in the reserves may increase also, but at the outset cuttings must be made most sparingly. It is different with the forests finally excluded from the demarcated reserves, which it is not intended permanently to maintain as forest for the production of teak, although certain areas may eventually be set apart as village forest. The teak growing in these forests may be cut out as soon as the trees

attain a marketable size. It is intended that the timber cut outside shall supplement the outturn of the demarcated reserves during the first period while these are worked sparingly.

**Number of trees proposed to be girdled during the next five years.**

227. In order to enable forest officers in Burma to devote their undivided time and attention to the work of demarcation, no regular girdling operations were undertaken during the four years 1875-76 to 1878-79. In 1879-80 the operations were resumed, being regulated by the general principles explained in the present Report. Hence the teak trees girdled by the Forest Department during the last five years have been as follows :

| Year. | Pegu Circle. | Tenasserim Circle. |
|---|---|---|
| 1875-76 ... ... | 3,576 trees | None. |
| 1876-77 and 1877-78 ... | None. | None. |
| 1878-79 ... ... | None. | 934 trees. |
| 1879-80 ... ... | 18,578* trees | 605* trees. |
| TOTAL ... | 22,154 trees | 1,539 trees. |

For 1880-81 the Conservator of Forests, Pegu Circle, has, I understand, submitted to the Chief Commissioner proposals for girdling operations, of which the following is an abstract :

| | Trees. |
|---|---|
| Prome Division, outside the reserves ... ... | 2,000 |
| Tharawaddy do. inside do. ... ... ... | 200 |
| Ditto do. outside do. ... ... ... | 7,800 |
| Rangoon do. outside do. ... ... ... | 3,000 |
| Toungoo do. outside do. ... ... ... | 5,000 |
| TOTAL ... | 18,000 |

The estimate of the number of trees that may be girdled annually must be framed separately for the reserves demarcated and proposed to be demarcated and for the forest outside. On the present occasion more will not be attempted than to frame an estimate for the next five years, from 1880-81 to 1884-85. Had the demarcation of the reserved forests been completed, it would have been possible to make this estimate in a methodical manner by discussing separately the working of each reserve and of the forest not included within the reserves. Under existing circumstances, the estimate must necessarily be rough and summary.

For the belt of demarcated reserves on the west face of the Pegu Yoma, which extend from the frontier to the Thoonzai forest, the maximum number of trees to be girdled annually during the next five years has already (paragraph 109) been fixed at 5,500.

For the Sitang forests a similar but more uncertain estimate has been framed, upon extremely imperfect data, the result being that in the forests demarcated and proposed to be demarcated not more than 4,000 trees a year must be girdled during the next five years. This includes the extraordinary girdlings proposed for the Kyouk-ma-sin forest.

In the remaining reserves demarcated and proposed to be demarcated in Pegu, that is, those on the Pegu (Zamayee) and Pounglin rivers and west of the

* These are the figures of the Annual Report for 1879-80.

Irawaddy, it is reasonable to suppose that 1,000 trees annually may be girdled during the next five years within the reserves demarcated and proposed to be demarcated. But here, as in the Sitang forests, the greatest caution must be used in selecting the localities for girdling and in selecting the trees to be girdled.

**Caution necessary in districts where demarcation has not been completed.**

228. In working on these lines, it must be clearly understood that the distinction between forests which will be included within reserves and those which will not be thus included must be strictly maintained. It is a deviation from correct principles, for which there is no excuse save the necessity of producing a larger revenue, to commence girdling operations in any division in which demarcation has not been completed. Serious and permanent injury to the forests through such action can only be prevented by the most scrupulous care in conducting girdling operations.

In 1880-81 it is proposed to girdle in the Pegu Circle 18,000 trees, of which only 200 will be within the limits of demarcated reserves. Outside the reserves it is proposed to girdle 2,000 trees in the Prome and 7,800 in the Tharawaddy division. In these two divisions demarcation has been nearly completed, and there can be no objection to the girdling of so large a quantity outside the reserves. In the Rangoon and Toungoo divisions, on the other hand, in which it is intended to girdle 8,000 trees outside the reserves in 1880-81, demarcation has made very little progress, and it may in many cases be difficult to determine whether these trees are within or outside the limits of the areas which will be included within the demarcated reserves.

229. No reliable estimate can be framed of the quantity of timber that will be available outside the reserved forests; but so much is certain that no object is gained by allowing marketable trees to stand outside the demarcated reserves. Under these circumstances, it is probable that in the Pegu Circle, during the next five years, 4,500 trees a year can be cut outside the demarcated reserves. This is for Pegu. In Tenasserim it will, for reasons which will presently be explained in detail, not be expedient to girdle more than 1,000 trees per annum.

**Summary.**

230. These suggestions may be summarized as follows:

| | Area demarcated and proposed to be demarcated. | Number of trees to be girdled. |
|---|---|---|
| A.—Reserves on the west side of the Pegu Yoma, from the frontier to Thoonzai (including Nawing) ... | 944 square miles. | 5,500 |
| B.—Reserves, Sitang Valley ... | 1,006 do. | 4,000 |
| C.—Remaining reserves, Pegu ... | 881 do. | 1,000 |
| D.—Outside reserves, Pegu ... | ... | 4,500 |
| E.—Tenasserim ... ... | 643 do. | 1,000 |
| TOTAL ... | 3,474 | 16,000 |

16,000 trees, at 75 cubic feet per tree, should yield 24,000 tons of timber. But it may be assumed as certain that, with the dry timber in the forests and the drift timber, a certain quantity of which is collected every year, the annual outturn will much exceed this figure.

In this respect it will be instructive to consider the following figures, which state the trees girdled in, and the timber extracted from, 18 forest districts in three divisions of the Pegu Circle during the 11 years from 1868-69 to 1878-79 :

| Forest Divisions. | Forest Districts. | Trees girdled. | Timber extracted. |
|---|---|---|---|
| | | | Tons. |
| Eastern Prome | (1.) Boolay and Choungoungyee .. | 1,902 | 6,896 |
| | (2.) Nawing and Choungzouk ... | 7,098 | 13,249 |
| | Total ... | 9,000 | 20,145 |
| Tharawaddy | (1.) Shaboung ... ... ... | 3,029 | 4,772 |
| | (2.) Shwaylay ... ... ... | 7,404 | 13,121 |
| | (3.) Toungnyo ... ... ... | 4,632 | 15,654 |
| | (4.) Minboo and Kangyee ... ... | 1,000 | 5,744 |
| | (5.) Boben .. ... ... | 2,017 | 20,790 |
| | (6.) Tounchoung... ... ... | 2,002 | 7,286 |
| | (7.) Gamoong, Kadet, and Ngapiin ... | 2,008 | 9,492 |
| | (8.) Minhla ... ... ... | 4,025 | 9,460 |
| | (9.) Mokka ... ... ... | 1,003 | 5,285 |
| | (10.) Koon and Kadin Beeling ... | ... | 20,443 |
| | (11.) Thoonzai ... ... ... | 4,015 | 4,695 |
| | (12.) Miscellaneous ... ... | ... | 257 |
| | Total ... | 31,135 | 116,999 |
| Rangoon ... | (1.) Oakkan ... ... ... | 1,000 | 2,122 |
| | (2.) Magayee .. ... ... | 1,000 | 974 |
| | (3.) Maizalee ... ... ... | ... | 110 |
| | (4.) Pounglin ... ... ... | 2,000 | 2,060 |
| | (5.) Zamayee and Pegu ... ... | 2,000 | 17,227 |
| | Total ... | 6,000 | 22,493 |
| | Grand Total ... | 46,135 | 159,637 |
| | Average per annum ... | 4,194 | 14,512 |

Thus during the last eleven years timber has been extracted from these forests at the rate of $3\frac{1}{2}$ tons for each tree girdled. This excess was due to the large quantities of dry and old girdled timber in the forests, most of which has now been worked out. Nevertheless, we are probably justified in expecting that, if 16,000 trees are girdled, the annual outturn will not be less than 32,000 tons of timber ; so that, with drift timber and the yield of the Pandaw and Attaran forests in private hands, an annual outturn of 35,000 tons from the forests in British territory may confidently be anticipated.

231. This yield must suffice for the present. According to our present estimate, this will require the girdling of 11,500 trees within the reserved forests, and 4,500 trees outside. Of the 11,500 trees proposed to be girdled within the reserves, 1,600 trees in the Kyouk-ma-sin forest will be an exceptional and temporary yield, which cannot be expected to continue at that rate beyond the next five years. The timber cut outside must eventually diminish, and at last come to an end ; but it is probable that during the next five years, and probably during a longer period, it can be maintained at the figure now fixed.

Eventually, when the outturn from the forests outside the reserves diminishes, a larger number of trees must be girdled within the reserves; but within the next five years the number of trees girdled within the reserves should not be increased beyond the figure here fixed, and, if possible, there should be no considerable increase for many years to come. Of course if the supply from beyond the frontier should at any time diminish considerably, it would be necessary to cut more heavily in the Government forests. Otherwise, it will be well to girdle most sparingly and with great caution in the demarcated reserves. There is, however, no ground for anticipating any marked decrease in the imports from beyond the frontier. Unless affected by unforeseen circumstances, they will continue to be very considerable for many years to come.

**Arrangement of operations and selection of trees to be girdled.**
**Outside the reserves.**

232. Most of the timber girdled outside the reserves is in places easily worked, and by girdling large quantities of timber standing in one place, it will be possible to get this timber brought out at lower rates than have been paid hitherto. The selection each year of the localities for girdling and of the trees to be girdled must be made chiefly with this object in view, to reduce the cost of timber operations.

Where demarcation has nearly been completed, as on the east side of the Irawaddy valley, the girdling of timber outside can be arranged according to a regular plan, the main object in view being to reduce the cost of extracting the timber. Where demarcation has not yet been completed, great caution must be used as already explained, and wholesale girdling must be permitted in such forests only as are certain to be excluded from the reserves.

**Within the demarcated reserves.**
**Pegu.**

233. Within the demarcated reserves the leading principle in the selection of the trees to be girdled must be to treat each locality on its merits, and always to keep in view that the reproduction of teak must, if possible, be promoted and, at all events, must not be impeded by the removal of the trees girdled. And these observations, it must be borne in mind, are applicable not only to reserves actually demarcated, but equally so to forests which it is proposed to include within the limits of reserves. Hence it will be necessary, when selecting the trees to be girdled, to distinguish between the different classes of forests which are found in all teak-producing tracts. It is not here the object to attempt a detailed account of the great variety in the character of the teak forests, which is caused by elevation, soil, the associates of teak, and other circumstances. My present object is merely to draw attention to a few great classes, the distinction of which is so far of practical importance as it influences the considerations which must guide the selection of the trees to be girdled.

In the great mass of the forests teak is found mixed with bamboos, pyinkado, and a great variety of other trees; but in such mixed forests are not rarely found belts or patches, often occupying the tops of ridges, varying in size and of irregular shape, which are chiefly or entirely stocked with teak. In localities of the latter description a very simple rule can generally be followed, viz., to cut out all marketable trees, provided a sufficient number of the younger classes is on the ground. In mixed forests, on the other hand, cuttings must be made more sparingly and with great caution.

Again, teak-producing forests may be classified from another point of view, viz., the prevalence of the trees of the larger and smaller sizes. In this respect the most useful classification at the present time is to distinguish between forests in which the trees above six feet in girth prevail and forests in which the trees in girth between eighteen inches and six feet predominate. In forests of the first class teak must, as a rule, be girdled sparingly, while in forests of the second class all or at least the greater portion of the marketable trees may be cut, provided teak is sufficiently plentiful.

234. This rule, however, must be applied with discrimination. There are tracts, such as the Kokee forest in the Shwaylay district, which in places have comparatively few trees of other kinds and a large proportion of teak trees, most of which belong to the first class, while there are few, and in places none, of the smaller classes. At present, while the forest burns annually, there is no chance of young teak springing up; but as soon as fire-protection has been firmly established, a large proportion of the larger trees should be cut to give light for young teak to come up. Hollow and otherwise useless trees would then be left to shed seed, as well as vigorous trees which have just attained first class size, and which may be expected to increase in girth under the beneficial operation of protection from fire.

**Teak in bamboo forest.**

235. With rare exceptions, teak in Burma is found associated with bamboo, and the main point which should be kept in view when selecting teak trees in bamboo forests for girdling is, how will the forest be affected by the next flowering and seeding of the bamboo. Forest of *Dendrocalamus strictus* (Myin-wa) presents the problem in a different aspect from that of most other species of bamboo in Burma; for of this kind occasional clumps will always be found here and there in flower and seed, while most other species flower gregariously over large areas. Seedlings and shoots of underground rootstocks of teak have a chance of coming up after the bamboo has seeded, and for this reason no bamboo forest which contains teak should be left without seed-bearing trees. Many other points merit consideration in connection with the seeding of the bamboo, which it would lead too far to discuss here. The variety in the character of the teak-producing tracts is so great that it is out of the question to prescribe definite rules for the selection of the trees to be girdled. Not only the present character of the forest, but also all circumstances which are likely to affect it within a reasonable time, such as the flowering of the bamboo, must be taken into consideration, and the only safe guide is that the growth of teak must be promoted to the utmost.

**Operations on the east side of the Irawaddy Valley.**

236. For the eight great forest districts into which the demarcated reserves on the west side of the Pegu Yoma, in the Thayet, Prome, and Tharawaddy districts, have been divided, an attempt has been made (paragraph 109) to fix the number of trees which may during the next five years be girdled annually in each. As already explained, these numbers must be regarded as tentative. Experience may show that they have been fixed too low or too high; but as a temporary measure they may be accepted. I recommend that, as a rule, girdling be carried on annually in each district. The advantage of this arrangement will be that the timber operations are spread uniformly over the whole of the forests, and that timber contractors will directly benefit by the operations of each year. Thus the Toungnyo forest is at present worked by five contractors, and 900 trees a year are to be girdled in that forest. It will not be possible every year to girdle in the area worked by each contractor, but at all events they know with certainty what to expect; and the contractor whose turn it is will be sure to make good arrangements to select the locality where the trees to be brought out by him shall be girdled, and to give efficient assistance to facilitate the work. Whereas if the forests were taken in turn, and if the number provided for the whole was girdled in one district at a time, as was the case formerly, contractors would naturally take less interest in this business.

237. The arrangement now recommended will have many other advantages, but it will each season impose heavy work, spread over all forest districts, upon the divisional officer. Thus the Tharawaddy officer, even if he were to give up the Shwaylay and Shaboung forests to Prome, to which civil district they belong, will have to carry on girdling operations in five different forests, and this must necessarily occupy his time as well as that of the two Forest Rangers, exclusively during three months at least of the dry season.

The selection of the trees to be girdled in the demarcated reserves, demarcation, and cultural operations are the three great branches of work which require the personal control of responsible officers in the forests. Mistakes made in the selection of trees to be girdled are most injurious and difficult to repair. It stands to reason that in a mixed forest where teak, being the only saleable tree, forms only one of the constituents, the condition of the forest cannot improve if one teak tree after the other is cut out. Fortunately, teak possesses exceptional powers of reproduction; otherwise, the species would long ere this have been extirpated in British Burma.

The forest tracts where the removal of mature teak trees is an unmixed advantage, are few and of limited extent. The condition of the great majority of our teak forests would decidedly improve if no teak at all were girdled in them for a long period of years. As a rule, the removal of every teak tree must to some extent cause the forest to deteriorate, and such deterioration can only be guarded against by careful selection, by the removal of other trees, and by sowing and planting.

So much will be clear, that in forests demarcated or proposed to be demarcated, the selection of the trees to be girdled must not be left to subordinates, or to officers with insufficient experience.

**Oporations in other districts in the Pegu Circle.**

238. In those districts where demarcation has not been completed, it will not be possible to allot a number of trees to be girdled to each forest district Operations must, therefore, be carried on where circumstances may render it most advisable. Thus during the past season (1879-80) 2,000 trees were girdled in the Lower Zamayee forests, because the work could conveniently be combined with the preliminary selection of a reserve in that district. 4,182 trees were girdled in the Kyouk-ma-sin forest,* which had never been worked previously, and where it was desirable to commence work on a large scale.

**Tenasserim Circle.**

239. It is probable that it will only be possible to girdle 1,000 trees annually during the next five years in the forests of the Tenasserim Circle. This, however, is purely temporary, until demarcation in the Thoungyeen forests has been completed, when it is believed the number may be increased considerably. The same principle should be followed here as in Pegu, viz., that outside the areas demarcated and proposed to be demarcated as reserves all mature and marketable trees should be girdled. Within the reserves the selection of the trees must be regulated by the same considerations as in Pegu, and the trees to be girdled must be selected most sparingly.

**Three working Circles proposed.**

240. As regards the general arrangement of the work, it will probably be best, after demarcation has been completed, to establish one working circle for the West Salween forests, comprising the Beeling, Doomdamee, Yoonzaleen, and Upper Salween forests; a second working circle for the Thoungyeen, and a third for the Government forests in the Attaran.

The forests which will constitute the West Salween working circle are small in extent and have been much overworked. The best thing that could be done for them would probably be not to cut any teak for the next 50 years. The next best plan would be only to cut out old trees here and there. If this plan is adopted, then I suggest the following arrangement, which should, however, not take effect until demarcation in this working circle has been completed or nearly completed. The cutting out of all old marketable trees that may be cut without impairing the condition of the forests should be distributed over a certain period, the length of which must be arbitrarily fixed in the first

* It is for consideration whether these 4,182 trees girdled in the Kyouk-ma-sin forest should not be regarded as part of the 8,000 trees proposed to be girdled in that forest during the next five years.

instance, and may in the present case be fixed at twenty years. Of this period a number of years would be allotted to each forest district in proportion to the extent and productiveness of its teak-producing tracts. In order to illustrate what is meant, I put forward the following allotment, which must be modified after demarcation has been completed, so as to accord with the productive powers of each forest district:

| | | | | |
|---|---|---|---|---|
| 1. | Doomdamee ... ... ... | 6 | years, | 1881 to 1886. |
| 2. | Beeling ... ... ... | 4 | „ | 1887 to 1890. |
| 3. | Yoonzaleen ... ... ... | 4 | „ | 1891 to 1894. |
| 4. | Upper Salween ... ... | 6 | „ | 1895 to 1901. |
| | TOTAL ... | 20 | „ | 1881 to 1901. |

What is intended is, that the whole operation shall be completed in twenty years; but it does not follow that trees shall be girdled every year. On the contrary, considering the small area of these forests, it will probably be found most convenient to complete these cuttings in each forest district in one or two years, and then to suspend girdling until the time assigned to the next district arrives.

It should be distinctly understood that by the cuttings here proposed it is by no means intended to cut out all marketable first class trees, but only to make a cautious selection of the trees that can be spared. At the close of the period of twenty years, it may be hoped that the condition of the teak-producing tracts will have improved greatly through protection from fire and cultural operations, and that then a new and more regular plan can be framed.

The trees outside the reserved forests may here, as in other parts of the province, be cut whenever it may be most profitable to do so, after demarcation has been finally completed, but it will probably be found convenient to girdle them simultaneously with the girdling in the reserved portion.

The plan here suggested will unavoidably have the effect of producing an exceedingly fluctuating yield from this division—one year more, one year less. But the whole present outturn of the West Salween forests will be so small that this inequality in the yield is not likely to be a matter of much consequence.

A similar plan I would at present advocate for the Thoungyeen and the Attaran working circles, as it is quite impossible, in these as well as in the West Salween forests, to suggest any maximum number of trees to be girdled annually. In the Thoungyeen, it is my distinct opinion that girdling operations must be suspended until the demarcation of the forests to be permanently maintained as such has been completed.

In the Attaran forests I do not at present recommend any girdling in those reserves which comprise areas held under 30 years permits. It is better, in order to guard against complications, not to girdle any timber in these forests while these permits are in force. They will expire in 1896, and Government will then be at liberty to treat them in a systematic manner. Hence I would suggest that girdling operations be confined at present to the Dalee, Nat-choung, and Pakaboa forests, which do not contain any blocks for which permits are held.

If these proposals are accepted, it seems probable that, for the present, not more than 1,000 teak trees a year can be girdled in the whole Tenasserim Circle.

**Record of girdling operations.**

241. A detailed record should be kept of all girdling operations, and this record must be prepared with special care for the girdling done in demarcated reserves.

Outside the reserves the sole object is to obtain a large supply of good timber and to reduce the cost of extraction. The work should be concentrated on as small an area as possible, and the record should give a brief account of the locality, clearly defining the limits within which the trees were girdled. The number of girdled trees should be stated, and a summary account should be added of the trees of the smaller classes, in girth 18 inches and upwards, standing on the ground where the mature trees were girdled.

For the operations undertaken within the limits of the reserves the record must be more full and detailed. The aim must be to concentrate each year's work in each forest district within well-defined limits. It will be necessary to take in hand a defined sub-division of the forest district, although it may not yield the full number fixed as a maximum. The deficiency may, if deemed necessary, be made up another year in another block. The limits of the sub-divisions should be so arranged that they may facilitate the final sub-division of the reserve into blocks and compartments. A sketch map and a brief descriptive account should be prepared of each block in which girdling operations are undertaken. The opportunity should be used to cut creepers, and to cut any bamboos and other trees which overtop teak. A necessary precaution outside the reserves, as well as inside, is to clear away dry branches, bamboos, and other inflammable matter, from the foot of every girdled teak tree. The selection of the trees to be girdled is a troublesome operation, entailing much exposure and fatigue. It requires time to locate the officer and his establishment in the forest where operations are to be undertaken, and it is well to utilize the opportunity, in order to obtain a good knowledge of the block in which the work was done. The sketch map should be made as complete as circumstances may permit. The descriptive account should be based chiefly upon linear valuation surveys. These linear surveys, if properly made, give a sufficiently good idea of the constitution of the forest for our present purposes.

**Classification of trees.**

242. It will be useful here to repeat the chief points which must be attended to in making these valuation surveys. First, as regards the classification of the trees, it will, in my opinion, be best to maintain the present girth classes, as established in 1856 and slightly modified afterwards, which have been found to answer our present purposes. They are as follows:

I.—First class trees—six feet in girth, measured at five feet from the ground.*

II.—Second class trees—four feet six inches to six feet in girth, measured at five feet from the ground.

III.—Third class trees—one foot six inches to four feet six inches in girth, measured at five feet from the ground.

The object is not to obtain an accurate measurement of the trees, or to determine their cubic contents. Such data are not required in the present stage of forest management in Burma. What is wanted is to ascertain the number of mature (first class) trees in the block and the number of the trees of the younger classes which, within a certain number of years, may be expected to replace the trees of the first class. Girth classes are not age classes, for the rate of growth of teak, as of other trees, varies according to circumstances, but size classes are the nearest approximation to age classes we have.

Girth classes, and not diameter classes, were established in 1856, because it was the local custom to measure the girth and not the diameter. And I advocate the retention of girth classes, because measuring tapes are more easily carried than diameter gauges, and this is a matter of consequence on the hot hills where the teak grows. No practical object would be gained in these valuation surveys by the greater accuracy which the diameter measurement

* The reason why, in Burma, I recommend that the measurement should not be taken breast high as in Europe is that buttresses and other irregularities of the stem generally reach to a higher point in Burma than in Europe. From five feet upwards the trunk is generally cylindrical, so that it makes no difference whether the measurement is taken at five feet or six feet, or between the two, provided it is taken where the stem is cylindrical.

would furnish. Long experience has shown that it is easy to accustom the eye to distinguish the trees belonging to the three classes named without measurement, and obviously it is a matter of the greatest importance to survey as large an area as possible within a short time.

**Valuation surveys.**

243. The lines surveyed should be entered on the sketch map as correctly as possible. This is essential, and for this purpose distances and angles must be measured, and all topographical details along the line surveyed must be entered in a field book. If this can be done with accuracy, it will be found to be a great advantage, and will help in the construction of the sketch map. Otherwise, the length of the track must be measured, and the direction must from time to time be determined by the pocket compass. Each valuation survey should commence and terminate at a point, the position of which can approximately be entered on the sketch map; and in order to facilitate the comparison of valuation surveys made at different periods, it will be well to arrange that every series of valuation surveys should commence and terminate at a well-marked permanent point, for instance at the crossing of a river, the junction of two streams, and the like.

**Record of valuation surveys.**

244. The form in which these valuation surveys are recorded is well known, but it may be somewhat simplified. The following are the essential columns:

1. Current number of survey.
2. Date.
3. Name of officer by whom the survey was made.
4. Name and situation of forest tract.
5. First class teak trees counted.
6. Second do. do. do.
7. Third do. do. do.
8. Area in acres.
9. Remarks.

In paragraph 109 of this Report the forests east of the Irawaddy river have been divided into eight great forest districts. This division had better be maintained for the present, and a similar arrangement should be made for the other forests. The valuation surveys of each forest district should be entered in separate books, and should have a separate set of running numbers.

The trees of the three classes are counted within a certain distance on both sides of the measured line. Experience has shown that a distance of 50 feet on either side is convenient in most cases, and a standard width of 100 feet may, therefore, as a rule, be adopted. The men who count the trees of the three classes call out the numbers and mark them simultaneously on bamboos split and marked for the purpose. Besides the men who count, one man is required with a ten-foot bamboo to determine from time to time the width of the track, and another to measure trees in cases where it is doubtful to which class they belong. For this purpose the most convenient measure is a thin pliant strip of bamboo (nhee-wa) six feet long, with marks on it at eighteen inches and four feet six inches. The "Remarks" in the last column should be arranged under the following heads: 1st, locality; 2nd, soil and underlying rock; 3rd, other trees and bamboos; 4th, growth of teak; 5th, general remarks. Under "growth of teak" the following points should be noted: height and stature of the trees, shape of stems (regular or otherwise), rate of growth, hollow trees, effect of toungya cultivation, fire and other injury, seedlings and saplings abundant or scarce. Where they can be counted, it will be convenient here to state the number of stumps, logs, girdled and dead (nathat) trees, of trees attacked with creepers and epiphytic *ficus*. For some of these data separate columns were provided in the older forms of valuation surveys. But as they cannot always be counted, the arrangement now proposed will probably be found to be more convenient.

It will often be found convenient to group several numbers together and to write one set of remarks for a number of valuation surveys.

**Descriptive account of blocks.**

245. In this manner the materials will be collected for a descriptive account of the block, and for an approximate estimate of the growing stock of the different classes. An attempt should be made to estimate the total area of the block and the area stocked with teak-producing and other forest, and a summary should be given of the growing stock of the different classes as determined by the valuation surveys. Proposals for works to facilitate the export of timber, for cultural operations, for roads and bridle-paths, and for the treatment of the forest generally, will suggest themselves, and should be entered in the report.

The next block for girdling operations should, if possible, be selected contiguous to the first, and thus a sketch map and descriptive account, based upon valuation surveys, will gradually be prepared for the entire forest district. This, in my opinion, is the only safe and practicable plan to lay the foundation for a comprehensive working plan of each forest district, and to test the correctness or otherwise of the maximum annual yield, which in the present Report has necessarily been fixed in a somewhat arbitrary manner. I do not think that it would be right to undertake girdling operations on a large scale within the forests demarcated and proposed to be demarcated in any other manner than that here suggested.

This working plan will comprise proposals for girdling, as well as for all operations for improving the forest that may be required.

**Officers required for this work.**

246. The only drawback to this plan is that it will probably require the services of more officers of the superior staff than are at present available in Burma.

A glance at the statement recorded in paragraph 109 of this Report will show that the Tharawaddy civil district comprises five large forest districts, in which an aggregate of 3,800 trees are to be girdled annually. The control of these girdling operations, the valuation surveys, preparation of the sketch map, and the examination of the forest for the purpose of drawing up the descriptive account of the blocks in which the year's operations are carried on, will probably require the undivided attention of two officers during an entire working season. These officers may be made available to assist the divisional officers in cultural operations, in the protection and working of the forests, and in other work. But the result remains that if the girdling operations are to be carried out in the manner here suggested, and if they are to be combined with the systematic examination of the blocks assigned for each year's work, the officer in charge of the Tharawaddy division will require two competent officers of the superior staff to assist him. For the same purpose the officers of the Toungoo, Rangoon, Prome, and Thayet divisions will each require one assistant.

**Girdling in the Karen areas.**

247. An important question has arisen—How the Karen areas should be treated: whether trees should be girdled within them, and whether they should be included in the valuation surveys and descriptive accounts to be prepared of the blocks which constitute the reserve. This question is important, for their area is considerable. In paragraph 109 of this Report it has been shown that of the total area of demarcated reserves on the east side of the Irawaddy valley, from the Thoonzai northward (1,157 square miles), not less than 213 square miles are included within Karen areas. In some of these reserves, as in the Tounchoung, Gamoong, and Minhla, the Karen areas form one-third of the total (47 square miles in 140).

These Karen areas form a portion of the reserves; they are strictly protected, except that the Karens are permitted to cut toungyas and to provide themselves with wood, bamboos, or other forest produce for their requirements. In some cases it is possible that the areas assigned will eventually be deserted by the Karens, as they will settle in the plains and take

permanent cultivation. But such cases will be the exception and not the rule. There are, however, included in every Karen area tracts of teak forest, particularly on the ridges which are dry and not suitable for toungya cultivation, and which will always yield a quantity of teak timber. Experience must show whether it will be possible eventually to place such tracts under special protection.

Under these circumstances, my advice is to regard the Karen areas as separate blocks in the reserves, the treatment of which must be left an open question for the present. There can, however, be no objection to the girdling of mature timber in the Karen areas on the same principles as in the rest of the reserved forests.

**Rate of growth.**

248. It has already been mentioned that in making valuation surveys in connection with the girdling operations, the rate of growth of teak shall be noted and recorded. The rate of growth of teak on good soil, carefully protected from fire, has been discussed in paragraph 203 of this Report, and it has there been shown that there is a vast difference between the rate of growth in a forest which is burnt annually and in a locality which is continuously protected from fire. In the limited area which we are at present able to protect from fire, we shall doubtless find that not only a larger number of saplings and seedlings spring up, but also that the young trees already on the ground attain maturity in a much shorter time than in the neighbouring forests which are burnt annually. The first clear proof of this will be obtained by examining the outer rings of trees felled in forests which have for some time been protected from fire.

If the 50 logs examined by Dr. Schlich in 1868, as explained in the paragraph quoted, represent correctly the mean rate of growth in forests not protected from fire, trees four feet six inches in girth would attain six feet in 72 years, which means that in the outer strata of the wood near the circumference of a tree six feet in girth there would be 25 rings in one inch of radius. When trees are felled in forests protected from fire, the outer rings will be found to be much wider, and it will not be surprising to find the average to be ten rings per inch of radius, which corresponds to an interval of 28 years between a second and a first class tree—the present estimate for plantations.

249. Up to this we have spoken of a mean rate of growth in forests protected and in forests not protected from fire. But in reality the rate of growth of teak, as of other trees, varies extremely in different forests and in the same forest under different circumstances. In paragraph 27 of the Report on the Working Plan of 1868 the following instances are given as showing great variations in the rate of growth in different forests :

As an instance of extremely slow growth should be mentioned a number of teak trees of different ages, which have been measured periodically near Way village, in the Thoonzai forests. These trees appear to have required 119 years to attain a girth of four feet six inches and 181 years to grow up to six feet. The locality is a dry narrow sandstone ridge, with precipitous sides, where an exceedingly slow growth might naturally be expected.

For a more rapid growth, it may suffice to refer to the trees noted above, which were examined in the Houndraw forests by counting concentric rings :

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4 | trees, | average age | 82 | years, | girth | 7′ | 10½″ |
| 6 | do. | do. | 93 | do. | do. | 6′ | 9 ″ |
| 5 | do. | do. | 216 | do. | do. | 10′ | 7½″ |
| 3 | do. | do. | 249 | do. | do. | 12′ | 8¼″ |

Also to six trees between three feet and fifteen feet in girth, measured in the Thouk-yegat forests, on undulating ground (granite), which showed an average annual increase in girth of one and-a-half inches, thus indicating an exceedingly rapid growth in that locality.

The valuation surveys made of a tract of country in the Hpyoo and Khaboung forests, and noticed in paragraphs 135 to 140 of this Report, indicate a much more rapid rate of growth than the estimate of 1868, even in forests not protected against fire.

In one and the same forest district, trees which have grown on level ground with good soil will show larger annual increments than others standing on steep rocky slopes, or on narrow ridges. Again, trees which have grown up while crowded will show a larger number of annual rings on one inch of radius than trees which have had room to expand.

**Rate of growth affected by fire-protection.**

250. What then is the object of making observations regarding the rate of growth of teak, and how should such observations be made? It is of great importance to ascertain to what extent the annual increments are affected by fire-protection. The advantages of fire-protection are of three kinds—*first*, the increased production of seedlings and saplings; *second*, the absence of hollows and other flaws in the young trees growing up without fires; and *third*, the accelerated rate of growth of the trees standing on the ground.

The benefits under the first and second heads are somewhat distant and remote, while those under the third head are immediate. Obviously, it will be most important to ascertain the money value of the immediate effect of fire-protection. The increased value of the timber standing on the ground, if proved beyond all doubt, will furnish the best justification for increasing the area under protection and for the outlay incurred on that account. Hence, whenever fellings are made in fire-protected forests, the stumps should be carefully examined, and the width of the rings formed before fire-protection commenced, and afterwards should be noted. But in addition to this, a number of standing trees of different sizes should be measured annually, in order to determine their annual increment. Such annual measurements of standing trees were commenced in 1856 in the Thouk-ye-gat forest near Toungoo, and in 1860 in the Thoonzai forest near Way village. Unfortunately, these measurements were discontinued before definite results had been attained. The observations must be re-commenced, and the measurements now proposed will have the specific object of determining the improvement in the rate of growth by means of fire-protection. In order to attain this object, a number of sample areas must be demarcated in pairs—one inside the block protected from fire, the other outside. The two plots selected for comparison must be as much alike as possible in soil, description of trees and bamboos associated with the teak, and in other matters. The teak trees to be measured should be of different sizes, from eighteen inches girth and upwards; and the forest growth in their vicinity should not be too dense, so that the rate of growth should not be affected by the crowded state of the forest. For measurement, those trees only should be selected which have regularly-shaped stems and are sound and vigorous. All trees selected for measurement should be numbered and entered in a register. They should be marked at a point above breast high, where the stem is round and regular, and the measurements should be taken at two places, six inches above and six inches below the mark. In addition to measuring the girth, it will be well, if such can be done, to measure two diameters at right angles to each other, and always at the same points of the circumference. The mark adopted should be a horizontal line of paint, to be renewed every year at the time of measurement; or, if this should be found impracticable, a short nail of ironwood, cutch, or other hard wood driven into the bark of the tree.

251. As regards the season when these annual measurements should be taken, it is as a matter of course desirable that it should be done at the time when the growth is at rest, and this will probably be early in the hot season, when the tree is leafless. Accordingly, and until we see reason to alter our views regarding the season of rest, these measurements should be made in March or April.

I would suggest that, as a commencement, one pair of sample plots be selected in forest of kyathoung-wa or tin-wa, and another pair in forest of myin-wa.

**Mean rate of growth in the different Forest Districts.**

252. So far regarding the determination of the rate of growth in fire-protected forests, as compared with forests not thus protected.

In addition to this, it will be well to collect data regarding the mean rate of growth of the teak trees in each reserved forest. This may be done in two ways: *either* by examining the butt ends of logs at the Rangoon timber depôt; if this is done, the butt ends of the logs must be sawn off in order to obtain a horizontal section, which costs money and diminishes the value of the log: *or* by examining stumps in the forests. I favour the second plan, though it will require more time to carry out, because the results will be much more valuable. The object of this enquiry is to determine the mean rate of growth of the natural forest not protected from fire in each reserve. The object is not to ascertain the effect which bad soil, steep slopes, or other circumstances may have upon the rate of growth The effect of such circumstances is well known, and does not require any special enquiry. Trees of exceptionally slow or rapid growth should be excluded, and specimens of an average rate of growth should as much as possible be selected for examination.

253. In counting the rings, the plan which experience has shown to me to be the most convenient is to select a mean radius, on which the irregularities in the width of rings of the earlier and later years are least marked, to place a foot rule upon this radius, and to draw a pencil line, marking on this line sections of two inches each, commencing from the centre of the tree. The rings are then counted separately in these two-inch sections up to twelve inches, and the notation is as follows:

**Register of Rings counted in the Toungnyo Forest.**

| Current number of trees. | Forest tract. | Mean radius, in inches | Rings counted on sections of radius. | | | | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0 to 2" | 2" to 4" | 4" to 6" | 6" to 8" | 8" to 10" | 10" to 12" | 12" to circumference. | |
| 1 | Nyaulay | 14 | 15 | 16 | 12 | 14 | 20 | 25 | 40 | Here should be specified the locality, soil, and other circumstances under which the trees have grown up. |

Observations thus recorded furnish all data that may be needed for calculating the age of trees of certain sizes, due allowance for the thickness of the bark being made, as well as the mean annual increment at different stages of growth. In cases where time does not permit to count and note the rings throughout all sections of a mean radius, very useful results may be obtained by counting the rings on an inner and an outer two-inch section, the inner commencing at two inches from the centre and the outer commencing at eight inches from the centre. The former will give, with fair approximation, the rate of growth of trees up to three feet in girth; while the two together will give the age of trees up to six feet in girth. In this manner very useful results may be obtained by a rapid examination of a large number of stumps. And the comparative observations proposed to be made in sample plots protected from fire, and others not thus protected, will make it possible to estimate the rate of growth in each reserve after fire-protection has been introduced.

254. The counting of rings in the manner here suggested cannot, as a rule, be done in connection with the examination of the forest, which is contemplated when girdling operations are undertaken. It must be done in localities where timber has lately been felled, and it should be undertaken as a special work, independently of girdling operations. Excluding extremes, it will probably be found that the rate of growth in different blocks of one reserve varies within very narrow limits, so that the counting of rings

in one locality will, as a rule, suffice to determine the mean rate of growth in the entire forest district with sufficient accuracy for all practical requirements. Indeed, it is probable that the difference in the rate of growth of teak in different forest districts will not be found to be very great, so that the work of examining annual rings for the present purpose may be confined to one forest district in each division.

**Sketch Maps.**

255. It has already been said that simultaneously with the girdling operations and valuation surveys, a sketch map of the block where work is in progress shall be made. It is intended that from these sketch maps of blocks a combined sketch map of each demarcated reserve shall be prepared. There is no immediate prospect of an accurate topographical survey of any of the Burma reserves being undertaken: hence it is necessary that sketch maps of all demarcated forests, based upon the best available data, should be prepared as speedily as possible. As regard scale, two miles to one inch will probably be found to be most convenient. All valuation surveys made should be indicated on these sketch maps, and it will be convenient to enter along the line which indicates the track surveyed the year and current number of the survey and the number of the trees of the first three classes on one hundred acres, thus—

10—1891

.....

90—230—568

denoting that it was survey No. 10, and that the trees of the first three classes on 100 acres were—

| | |
|---|---|
| 6′ and upwards ... | 90 |
| 4′ 6″ to 6′ ... | 230 |
| 1′ 6″ to 4′ 6″ ... | 568 |

I prefer giving the number of trees on 100 acres, as this saves the use of decimals.

**Opening out of streams for floating.**

256. When systematic forest administration was commenced in Pegu after the annexation of the province, it was found that a large area of teak-producing forest was closed against the extraction of timber by obstructions in the streams. These obstructions are of two classes: those which are caused by the silting up of the mountain streams in the lower part of their course in the level country, and those which are caused by rocks in the hills.

**Obstructions in the Plains.**

The mountain streams which are used for floating timber come down from the hills with great velocity, carrying with them large quantities of sand, grass, reeds, drift wood, and rubbish of all kinds. When these streams enter the level country of the Irawaddy valley, the fall is considerably less, and the current being slackened, large quantities of sand and other drift are deposited. The immediate cause of such an accumulation of trees, branches, sand and silt is often an accidental impediment in the bed of the stream, caused by a fallen tree or by logs of timber not removed in time before the fall of the water. In his Report on the Irawaddy river,* Mr. Gordon states that in the Mahathaman plain, in the Prome district, "a network of irrigation channels had been constructed "[some twenty years ago] by the voluntary action of the people, under the super- "vision and direction of General David Brown, then Deputy Commissioner of "Prome. These extended some eight or ten miles over the country, the principal "ones being not over six feet deep by ten feet wide. At first they were very "successful, and they were thoroughly appreciated by the people, who long after "General Brown left Prome endeavoured to keep them efficient. They were "derived from an elevated point of the channel of the torrent, which filled them "with pure silicious sand after freshets. The cone of deposit from this torrent "spread over the flat country, not only injuring the cultivation, but ultimately "succeeding in stopping the irrigation. The sand was scooped out time after "time, but at length overpowered the available force for removing it."

* "Report on the Irawaddy River" (Part III., page 67) by R. Gordon, M. I. C. E. and M. I. M. E.

These deposits are increased by the circumstance that, in the season when the freshes from the hills come down, the lower country is flooded by the rise of the main river, the floods of the Irawaddy ascending the lower course of the mountain streams to a considerable distance. Heavy masses of sand, grass, reeds and branches are deposited where the water from the hills meets the floods from the main river, and the consequence is that obstructions are formed which impede the floating of timber. The bed of the stream becomes obliterated, the water overruns a vast area, and, after re-uniting in a large number of small channels, joins the main river. In the Forest Report for 1859-60 it is fully detailed how in consequence of such obstructions several of the great forests in the Tharawaddy district, particularly the Boben, Toungnyo, Shwaylay, and Shaboung, had formerly been closed.

**Measures taken for their removal.**

257. Various attempts, more or less successful, have been made to remove these obstructions and to maintain these streams fit for floating. In many cases it was found to be sufficient to burn or remove the rubbish and to keep the channel open by bringing timber through every year, and, when necessary, dragging it through by means of elephants. In other cases it was found necessary to dig regular canals. The largest work of this description was the canal constructed in 1860, below the Poungday-Prome road, to open out the Shwaylay forest. The following extract from the Report for 1859-60 may here be quoted :

The Shwaylay forests have hitherto been preserved almost intact by the stream having been blocked up with sand and rubbish in the plains west of Poungday. The bed of the river above this obstruction is 20 feet deep and 100 feet wide; but below the village of Weppoke its depth is only 3 feet and its width 40 feet; and further down it divides into numerous streamlets, which re-unite in one channel about two miles below the head of the obstruction. Only small pieces of timber have hitherto been brought away. Once only, about eleven years ago, a Myoke of Mogouk is said to have floated down several hundred large logs, and dragged them up the Meimakha river to Prome, where they were used in building zayats and kyoungs. But the channel that was open at that time has since silted up, and in order to render the seasoned timber in the forest available, it became necessary to dig a canal. This canal has been completed during the last dry season. It is 7,270 feet long, and has a depth varying from 4 feet 10 inches to 6 feet 2 inches, with a fall of nearly one foot in 1,000 and a width of 24 feet above and 12 feet at bottom.

These forests yielded no timber from 1856-57 to 1859-60, but commencing with 1860-61, since the canal was opened, they have yielded 29,713 tons, or on an average 1,564 tons a year during these nineteen years. In paragraph 19 of the Report for 1860-61 it was estimated that the Shwaylay forest, if well worked, ought to produce 1,000 logs per annum. This estimate has thus been more than borne out by the result. And there is no ground for believing that the forest has in any way been over-worked.

The yield of most forests in the Tharawaddy district has been largely increased by opening out obstructions in the plains. Similar obstructions existed, and to some extent still exist, in some of the streams which join the Irawaddy from the Arakan Yoma, and in some of the western feeders of the Sitang river, particularly those which drain the Bawnee forests.

258. The silting up of the streams descending from the Pegu Yoma, the inundations caused thereby, the irregular shifting of their beds, are all matters of old standing. Every year the crops over large areas of paddy-fields are injured by inundations, while other fields are destroyed by being covered with sand. The unsatisfactory state of these mountain streams, where they enter the plain of the Irawaddy and Sitang valleys, has often been ascribed to the floating of teak timber by the Forest Department. But these evils existed long before the Forest Department was formed. Before the annexation of the province, the streams of the Tharawaddy district habitually shifted their bed, the water seeking a new outlet when the old bed became obstructed by accumulations of sand, silt, and rubbish. The real cause, as correctly pointed out by Mr. R. Gordon in the report quoted (page 70), is the soft nature of the rock of which the greater part of the Pegu Yoma consists. These soft sandstones and calcareous shales disintegrate readily under the action of a

heavy monsoon, and during freshes the streams descend to the plains charged with silt and sand. This washing down of sand and silt is intensified by cutting and burning the forest over large areas annually for toungya cultivation, by the denudation of the slopes caused by these clearings, and by the annual jungle fires.

The measures which have lately been taken to confine toungya clearings within certain limited areas assigned to the Karens, to exclude fires from certain blocks, and to protect the forest generally, will do much towards diminishing the sand and silt carried down from these hills. An attempt made (by rule 17 of the Rules of 1865) to diminish the evil, by prohibiting the throwing into the streams of toungya refuse (branches, tall grass, bamboos) has not had much practical effect. The prohibition must be maintained, but more good may be expected from the gradual improvement of the demarcated forests on the hills of the Pegu Yoma.

**Other obstructions in the Plains.**

259. In some cases obstructions were caused or aggravated by dams thrown across the streams for fishing or for purposes of irrigation. During the first year after the annexation of Pegu such artificial obstructions threatened seriously to interfere with the floating of timber, but in 1858 the Commissioner of Pegu directed that such streams as were required for the floating of timber should not be let out for fisheries; and in the rules of August 1865 it was specifically provided (rule 17) that certain streams notified by the Chief Commissioner should not be closed or blocked up, neither for fisheries, irrigation, nor for other purposes.

Another class of obstructions is caused by trees and brushwood growing in the bed of the stream, behind and between which drift wood accumulates, thus impeding the floating of timber. Numerous streams blocked up in this manner have been cleared. As an instance may be quoted the Ngapiin stream, which was cleared in 1864 for a length of ten miles by Lieutenant Seaton when in charge of the Tharawaddy forests. In paragraph 26 of the Report for 1863-64 it is stated that "the results of a partial clearing of this stream were "so satisfactory that no doubt can be entertained of its fitness for the floating "of timber from the upper forests, which will obviate the necessity there has "been hitherto of dragging timber a considerable distance. It serves also to "show that most of the smaller streams in Tharawaddy can be made available "for floating purposes, if thoroughly cleared and if care be taken to watch the "timber coming down. In the Ngapiin stream every thing in the shape of "jungle, creepers, trees, stumps, and logs were removed from the bed and banks, "thus rendering its course throughout free for the passage of elephants and "coolies."

In the same manner the Padinben choung, a small feeder of the Toungnyo, which it joins low down in the plains, was cleared of jungle in 1867, the result being that 274 logs were floated out that year—an achievement which had never been considered possible.

In the soft alluvial soil of the plains it often happens that these mountain streams change their course, and that the new channel makes its way through the midst of forest which, if not cut, causes the stream to be blocked up. In this manner the Boben choung was cleared in 1862, and the Yoonben choung, an outlet of the Toungnyo, was made fit for floating in 1867.

**Obstructions in the Hills.**

260. Regarding the obstructions caused by rocks in the hills, the following extract from a letter addressed by me to the Commissioner of Pegu, on the 9th November 1858, may here be quoted:

You are aware that a remarkable feature in the geological character of the hills between the Sitang and Irawaddy, where the teak forests are richest and easiest of access, is the system of parallel ridges, running almost always from north-north-west to south-south-east, with a deviation from the north varying from 0° to 45°. Consequently, most streams in the upper portion of their course find their way through the natural valleys between these longitudinal ridges. But since, on account of the meridional direction of the

main valleys, all tributaries of the Irawaddy, Hline, Sitang, and Pegu rivers must assume a general easterly or westerly direction, the streams frequently have to break through the lines of elevation more than once, in right or oblique angles. The effects of these breaches are either narrow channels* cut out deep in the rock, or waterfalls,† the stream leaping over the strata of rock which it could not break through, or lastly, the remains of the violent commotion are left in the bed of the torrent in the shape of large boulders more or less obstructing the passage.‡

* Kyouktaga or Kyoukmyoung.
† Kyouk Kadin.
‡ Kyoukloongyee.

In a few instances, the cause of these obstructions is of a more complicated nature. Thus the famous Kyouktaga of the Pegu river, which has hitherto protected many square miles of the most splendid teak forest, is at a spot where the strike of the strata changes from 15° west of north to 15° east of north; and the stratification of the rocks near the Kyoukloongyee in the Thoonzai choung shows a similar irregularity. But the further explanation of this latter class of obstructions would lead into questions of a purely scientific nature.

Suffice it, therefore, to observe that almost every choung and most of their tributaries are, at particular places, more or less obstructed in their course through the hills. It is true that some of these obstructions offer no essential obstacle to the floating of timber, and that in others the difficulties in floating may be avoided by skilful management, men being placed on the banks to guide the logs with poles and bamboos, and thus to prevent their being squeezed in between the rocks or split by the shock against them; or use is made of the few days, often hours only, of very high floods in these torrents, which floods occasionally cover the rocks that form the obstruction. But a large proportion are altogether impracticable, and thus the number of localities from which teak can be made available is but small in proportion to the extensive tracts covered with teak forests in the hills.

I have hitherto only mentioned the central part of the country as offering these difficulties. But both the western Yoma (towards Arakan) and the hills east of the Sitang present similar obstructions. The teak over a large extent of hilly country along the Shwaygyeen river is at present unavailable, on account of the rocks in the upper part of the choung; and the Jadawa choung, one of the main branches of the Padashin choung, which joins the Irawaddy near Kyangyin, and is said to have fine teak near its upper course, is obstructed by a Kyouktaga, not more than one day's march from the Irawaddy.

These difficulties can only be removed by a series of blasting operations, which probably will have to be continued for a number of years. Some of the operations may be completed within a few days, others are likely to require months.

A party of Coringa blasters and blacksmiths was brought over from the Godavery works at Dowlaishweram, and they did excellent work for two years. But they suffered from fever and wished to return. A party of Karennees, therefore, was organized in 1862 and trained for the work, and these operations have been continued steadily during the last twenty years.

**Blasting operations.**

261. The following is a summary of these operations, as recorded in the Annual Reports.

1860-61.—*Outlay Rs.* 5,497.—(1.) Koon Beeling, a narrow channel in solid rock, so blocked up by a series of large boulders that it was a difficult task to climb over the boulders from one end of the passage to the other. The passage was opened, so that a cart might be driven along the bed of the stream. (2) Shawdoon choung, a tributary of the Koon Beeling. (3) Hmyah choung, a feeder of the Kadin Beeling. (4). Thoonzai main stream, described as follows in the Report for 1860 61, paragraph 20:

The chief obstruction in the Thoonzai district is in the main stream, about seven miles above the place where the stream emerges from the hills. The river here runs in the same direction as the strike of the strata, which is about ten degrees west of north. The strata are inclined at an angle of about 40 degrees, and the rock is composed of alternate layers of massive sandstone and soft clay-slate and shales.

The boulders which form the obstruction in the stream appear to have been the fragments of the massive strata which have detached themselves from the soft shales underneath and have glided down the inclined plane, until stopped in the bed of the stream.

The Thoonzai stream drains a large area, and after heavy and continuous rain the water in this locality rises to a great height, covering the boulders at the bottom of the bed sufficiently to admit of logs floating down without impediment; but these high floods only last a day or two and are rare. When the water is at its average height, the boulders are a serious impediment to floating. Now, since the blasting, it will be possible to float timber down the Thoonzai choung throughout the rains, whether the water is high or low.

(5.) Three minor obstructions, viz., Thoonzai Kyoukloonggalay, Yaygyee choung, and Nagyee choung.

1861-62.—*Outlay Rs.* 3,439.—(1.) The work commenced in the Shaboung stream, a feeder of the Shwaylay river. "In this stream," says the Report for the year (para. 32), "near the village of Gyoben Ein, there was a bank of "rock almostly completely blocking up the stream, the water finding its way "through crevices at low-water and overflowing the bank at high-water. Some "timber was last year brought over these rocks with difficulty with the help "of elephants, and for these animals it was dangerous work on the slippery "rock. When the water did not rise sufficiently high, no timber could be "brought out at all. A passage twenty-two feet wide and eight feet deep "has now been opened out through the bank by blasting. A similar passage "was opened five miles lower down in the Shaboung stream, near the village "of Shaboung, and two others in two feeders of the same—the Mageetsan and "Kyouk-O streams. A fifth obstruction was removed in the Bwet choung, "a tributary of the Shwaylay stream below the Shaboung." (2.) Beeling Kyouktaga, a narrow passage between two steep and high hills, completely blocked up by a number of detached boulders rendering the exit of timber quite impossible. (3.) Zamayee Kyouktaga, a long narrow winding passage with boulders in the Pegu river, about 64 miles north of Rangoon ; and three other obstructions above the Kyouktaga. (4.) Two passes filled with rock in the two main branches of the Minhla stream, viz., in the north branch twelve miles, and in the south branch four miles above the junction. (5.) Detached boulders in the Gamoong river.

The total quantity of rock removed this year was 150,421 cubic feet, on which 437 lbs. of powder were expended. These operations are rendered difficult by the great distance between the places where the work has to be done, their remote situation and great difficulty of access, the removal to a fresh place of work, several times during one season, of workmen, stores, and tools, and the unhealthiness of the forests even for the strongest constitution, especially of the damp localities in the rocky beds of streams where the work has to be done.

1862-63 (Chapter II. of Report).—*Outlay Rs.* 3,798.—In addition to obstructions at five places in the upper course of the Zamayee river, the Kyoukloongyee, boulders of rock, in the Thayet choung, a main branch of the Boben, were removed.

1863-64 (Section II. of Report).—*Outlay Rs.* 1,540.—The work in the Upper Zamayee was completed, five main obstructions were removed in the feeders of the Beeling stream, and further progress was made in clearing the upper part of the Shaboung and Shwaylay streams. In the Toungnyo stream, six miles above the village of Gwaygyee, the river runs through a narrow gorge, which was obstructed by huge boulders of unusually hard rock, of which 19 were broken and the passage cleared.

1864-65 (Section II. of Report).—*Outlay Rs.* 1,451.—In the Tharawaddy district operations were limited to completing the work begun in previous seasons in the Boben, Minboo, and Beeling forests. The main party, with a European Overseer (the late Mr. Hood), was sent to work at the obstructions in the Koon and Hpyoo streams, a few miles above the forest where those rivers leave the hills, which hitherto had almost completely prevented the export of timber from the inner hills drained by the streams. Since then these two streams have been open for the passage of timber, and have yielded over 20,000 tons during a period of 15 years. The employment of a European Overseer on this work was found necessary to prevent accidents and to ensure good progress in the work, which in Burma is hazardous and is liable to be interrupted by difficulties of all kinds.

1865-66 (Section II. of Report).—*Outlay not recorded.*—In Tharawaddy a series of minor obstructions were removed in the Myoung, Gamoong, Mokka, and Minhla forests. In the Sitang division work was done on the east side of the valley, in the Gwaythay and Koonoong streams. Here the rock is

gneiss and granite, and is much harder than the sandstone of the Pegu Yoma. During the rains the blasting coolies were, as well as in previous years, mostly employed in planting work.

*No blasting was done on Government account in* 1866-67; but it is reported that the permit-holders in the Koon and Hpyoo forests, Sitang division, cleared away some minor obstructions to facilitate still further the floating of timber over the rapids in these streams.

1867-68.—*Outlay Rs.* 880.—Assistance was given to the permit-holders of the Koon and Hpyoo forests to enable them still further to clear the courses of those important streams. Work was commenced this year in the Mudday and Thalaidan forests, west of the Irawaddy, and it was done jointly by the permit-holders and the Forest Department. The departmental blasting party was chiefly employed in the Beeling and Toungnyo forests.

1868-69.—*Outlay Rs.* 3,080.—In Tharawaddy the chief work was done in the feeders of the Shwaylay and Toungnyo choungs. In the Sitang division the work was continued in the hard crystalline rocks of the Koonoong district; and west of the Irawaddy the obstructions in the Shwaytanga forest were taken in hand.

In 1869-70 and 1870-71 no work for opening out streams was done.

In 1871-72 some work was done in the Thayet choung, a feeder of the Boben stream, at an outlay of Rs. 214.

In 1872-73 the work was on the head-waters of the Toungnyo stream, with the view of opening out some large teak tracts contiguous to the Yoma range. The outlay was Rs. 1,489.

In 1873-74 (paragraphs 93 to 99 of Report) Overseer Hood, who had been chiefly employed on this business, died, and the work in Tharawaddy was suspended in consequence. A commencement was made in the Salween division, where blasting operations were undertaken in the limestone rocks which obstruct the Houndraw river at a place called Kozay-ko-gyoon (99 islands), as well as at two localities above that place. The object was to open up the river for the export of thingan, thitkadoe, and thitka, which are plentiful near the head-waters of that river. The outlay was Rs. 2,179.

In 1874-75 (paragraphs 53 and 54 of Report) a large obstruction was blasted in the Hlowa choung, a feeder of the Mindoon river. The work was unusually difficult, partly on account of the hardness of the rock, which is almost pure quartz, partly owing to the bad means of communication. In the Tharawaddy district the Moaygyee choung, a feeder of the Toungnyo, was opened out. Outlay Rs. 1,743.

In 1875-76 and 1876-77 the work was continued in the Hlowa choung, west of the Irawaddy, at an outlay of Rs. 1,133 and Rs. 1,056 respectively.

In 1877-78 and 1878-79 some rocks were blasted in the Khadat choung, a feeder of the Pegu river.

**The opening of streams should be steadily continued**

262. The main object in giving a summary account of these operations is to draw the attention of the local officers prominently to this important branch of their work. It is not too much to say that of the whole outturn of timber which the Tharawaddy forests have furnished during the last 23 years, and which amounts to 198,000 tons, two-thirds could not have been extracted, had the streams not been opened by blasting and otherwise. The same may be said of the Pegu and Zamayee forests and of several important forest districts west of the Irawaddy river and in the Sitang valley. It must not be imagined that the work has been completed. Large areas of good forest still remain in most districts from which no timber can be exported at present, and which require the opening out of streams for the export of their timber. For the blasting of rocks in the hills two efficient parties of blasters, each under a competent Overseer, should be permanently maintained—one for work in the Irawaddy, the other in the Sitang valley. During the rains ample employment can be found for them on plantations. This was the custom formerly, and the practice should be resumed. The contractors will in most cases know their

forests sufficiently to make it possible to draw up lists of the obstructions which still require to be removed in each forest district, so that a regular plan of operations may be framed. In the commencement it was unavoidable to send the working parties about from one forest to another, in order to complete as soon as possible those works which were most urgently required. In future, the works should proceed regularly, district by district, and a new district should not be taken in hand until all obstructions known to exist in the last have been opened out. The detailed examination of the forests, block by block, may in many cases bring to light work of this description which requires to be done.

As regards the opening up of streams in the plains, many interests have to be considered. Under the forest rules it is prohibited to make dams for fishing and irrigation in streams which have been notified as required for the floating of timber. But in many cases the paddy-fields, especially those on high ground and on light sandy soil, benefit by the inundation which is the necessary consequence of obstructions in the channel. Thus, after the Shwaylay canal was dug in 1860, compensation was claimed and paid, to the extent of Rs. 2,154, for paddy-fields injured by the alteration in the drainage consequent upon making the canal. This was for a stretch of fields in high ground with sandy soil, on which paddy cannot be grown by means of the rainfall only. The fear of complications like these has naturally made forest officers in Burma unwilling to undertake similar works elsewhere. But if such plans are carefully considered beforehand by the civil officers, with the aid of engineers and forest officers, there is no reason why something should not be done to regulate the course of these mountain streams after they have entered the level country. While a few cultivators may benefit by the overflow of streams which have no proper outlet, others, and by far the larger number, suffer by these inundations in another part of the country. And the maintenance of made roads and railways absolutely demands that the channels of the mountain streams crossed by them should be kept open.

**Floating timber and bridges.**

263. This leads to the consideration of the protection to be afforded to bridges against injury by the floating of timber. The timber brought down these mountain streams comes with a rush in single logs during the freshes, and it is out of the question to raft it before it reaches one of the main rivers, the Sitang river below Toungoo, the Hline river in the Tharawaddy district, or the Irawaddy. Consequently, when bridges are built crossing such streams they should always be designed with due consideration of the fact that these streams must be used for the floating of timber in single logs. And proper precautions should be taken, by the erection of guiding posts, or by other arrangements, to protect these bridges from injury through such timber.

It is not the teak timber only, floated by Government contractors, which may cause damage to these bridges, but equally so the large and steadily increasing quantities of timber of other kinds which is brought down by private enterprize. It is not possible to arrange for rafting and guiding the timber above these bridges, and, as a matter of course, it is out of the question to stop the floating of timber on these streams. Eventually it may be hoped that the railway authorities may find it possible to carry timber to Rangoon at rates which are not prohibitory. Such a reduction of the rates would stimulate the extraction of timber for the Rangoon market from forests at a distance from streams, and it may perhaps make it possible to give up floating on some of the smaller streams. On the larger streams floating will probably always remain cheaper than carriage by cart and railway, but, as already stated, a reduction of the rates for carrying timber on the Rangoon and Irawaddy Valley State Railway would make it possible to send to Rangoon large quantities of timber, teak and other kinds, which at present cannot be utilized. It should, however, be borne in mind that the railway cannot be used for the carriage of timber, unless the Forest Department has a depôt for storing timber near the railway terminus at Rangoon, and that land for that purpose should be set apart as early as possible.

## CHAPTER VII.

### ORGANIZATION OF THE DEPARTMENT.

264. The following are the chief branches of work which devolve upon forest officers in Burma:

A.—Preliminary selection of the reserves, settlement of rights and privileges of the people, demarcation (that is, erection of boundary marks and clearing of boundary lines).

B.—Protection of the forests.

C.—Planting and other measures of improvement.

D.—Girdling operations and systematic examination of the reserved forests.

E.—Opening of streams for floating and communications.

F.—Working of the forests on Government account.

G.—Collection of revenue from forest produce exported for trade from the forests outside the demarcated reserves.

All this work is most important, and in the climate of Burma it entails a vast amount of fatigue and exposure. I do not now propose to enter into the question, whether the superior staff as sanctioned is sufficient to do justice to the whole of this work; but rather how the organization may be perfected, in order to enable the staff to accomplish as much of the work as possible.

#### Apprentices to be trained for the appointment of Forest Ranger.

265. The first and most important suggestion which I have to offer in this respect is, that a commencement should now be made to train a number of young men, Karens and Burmans, for Forest Rangerships. Among the older subordinate officers there are fortunately some good men, but there is a great scarcity of young men coming on to take their place. This is a serious drawback, and one to which the Conservators must at once devote most earnest and continued attention, if the work is not to come to a stand-still. Candidates who are not familiar with English should be trained in the province, while all those who are sufficiently acquainted with English should be sent to Dehra Dún for a regular course of instruction at the Central Forest School.

266. It has been decided by the Government of India that young men under preparation for the post of Forest Ranger, whether in Burma or at Dehra Dún, shall, unless they begin from below as Forest Guards or Foresters, be styled Apprentices. It has also been decided that there is no limit to the number of apprentices who may be entertained, except the requirements of the service. It rests with the Chief Commissioner to distribute the monthly maximum grant for subordinate establishments as may seem best to him; and, if necessary, apart from the amount sanctioned for permanent establishments, the Chief Commissioner may, in accordance with the orders of the Government of India, sanction the appointment of additional men as a temporary measure, as occasion may arise. If after having passed through their time of probation these men are not considered fit for the post of Forest Ranger, they must be employed as Foresters until they earn promotion to the higher class. Forest Rangers in Burma have a good prospect of meriting, by distinguished service, promotion to the class of Sub-Assistant Conservator.

267. All this is extremely simple, but it is necessary to explain it here, as the arrangements made by the Government of India to facilitate the training of men for the post of Forest Ranger have frequently been misunderstood. All that is wanted is that a sufficient number of apprentices be selected as soon as possible. The staff of Deputy and Assistant Conservators is small, and it must be regarded as uncertain whether it will be possible to increase it at present. The work in the forests, therefore, must, if the proposals of the present Report are to be carried out, chiefly be done by

Sub-Assistant Conservators and Forest Rangers; and the number of the appointments of these two classes should be increased as the requirements of the work may demand. The only limit to the increase of Forest Rangers is the monthly maximum amount sanctioned by the Government of India for subordinate establishments. As regards the prospects of promotion for Forest Rangers, four Sub-Assistant Conservators are at present sanctioned for Burma. But as soon as there are Forest Rangers in Burma, fit to be promoted to the class of Sub-Assistant Conservator, it will be good policy to increase the number of appointments in that class, as far as such may be necessary to give to Forest Rangers good prospects of promotion.

**Relation of Forest and District Officers.**

268. My second suggestion is, that effect should now be given to the wishes of the Government of India as expressed in the Circular Resolution of the Home, Revenue, and Agricultural Department, No. 39 F, dated the 20th October 1879, and to place forest officers in more intimate relations with civil district officers. Obviously, the first step in this direction must be to make the forest charges conterminous with the civil districts.

The principal forests are situated in the following districts:

| | | | |
|---|---|---|---|
| Pegu Forest Circle ... | 1. Thayetmyo ... ... | Pegu Civil Division. | |
| | 2. Prome ... ... | | |
| | 3. Henzada ... ... | | |
| | 4. Tharawaddy ... ... | | |
| | 5. Hanthawaddy ... ... | | |
| | 6. Toungoo ... ... | | |
| | 7. Shwaygyeen ... ... | | |
| Tenasserim Forest Circle... | 8. Salween ... ... | Tenasserim Civil Division. | |
| | 9. Amherst ... ... | | |
| | 10. Mergui ... ... | | |

It is not possible to make the civil divisions coincide with the circles in charge of the two Conservators. This, however, is no disadvantage; the main point to be aimed at is, that the charges of forest divisional officers must as much as possible be conterminous with civil districts.

269. To each of the districts a district forest officer should be posted. He should be the Assistant to the Deputy Commissioner for forest matters, and should, under the Deputy Commissioner's control, have charge of all forest business in the district, the control of professional, financial, and departmental matters remaining with the Conservator. The forest business in the Bassein district is probably not yet of sufficient importance to require a separate district forest officer, and arrangements must be made to have such business as there may be attended to by the Henzada Forest Officer, unless it should be preferred to place a Forest Ranger in charge of it under the Deputy Commissioner. Parts of the Doomdamee forests are situated in the Shwaygyeen Civil District; they must, however, nevertheless remain in charge of the Salween Forest Officer.

Again, there must be two district forest officers in the Amherst Civil District, one for the Thoungyeen and the other for the Attaran forests.

**Forest charges in Thayetmyo and Prome.**

270. The only real difficulty in carrying out this organization will probably be met with in the Thayetmyo and Prome districts, each of which, under existing arrangements, extends from the Pegu Yoma in the east to the Arakan Yoma in the west. The work of the forest officer in these two districts is chiefly in the hills; and instead of the Prome and Thayetmyo officers having their forests close together in a compact area, they are divided into two ranges, which are separated by the entire breadth of the Irawaddy valley; so that the distance from forest to forest is 40 to 60 miles of open, exceedingly hot, and dry country. There will thus be a great waste of strength and time for the forest officer in moving from one part of his charge to the other; and if it were possible to alter the limits of the civil districts, so as to give to Thayetmyo the country west of the Irawaddy river, comprising the townships of

Thayet, Mindoon, Kama, and Padoung, and to Prome the country east of the river (Myeday, Mahathaman, Prome, Shwaydoung, Poungday, and Shwaylay), the arrangement would be much better for the forest business. One forest officer would then have the forests along the Pegu, and the other those along the Arakan Yoma, and each could attend to his work with much less exposure and loss of time than is possible at present. This arrangement, if it were practicable, would probably save the services of one officer. Under the present organization of districts, it will be necessary to give an assistant each, to the Prome Officer for the charge of the forests west of the Irawaddy, and to the Thayetmyo Officer for the charge of those situated east of that river.

**Shwaylay and Shaboung.**

271. It will have to be considered whether the Shwaylay and Shaboung forests should remain under the Tharawaddy Officer, though they belong to the Prome Civil District. As regards the export of timber and convenience of supervision, the present arrangement is certainly the best; but such considerations must to some extent give way to the general principle of making civil and forest charges conterminous.

It would be unreasonable to expect that the organization here sketched will facilitate the forest work proper; but there are great compensating advantages, the most important of which is, that the time of civil and forest officers will not any more be taken up by needless discussions, but that they will cooperate in all matters. It may also be expected that, for the protection of the forests, forest officers will to a greater extent, than is the case at present, have the assistance of the police and the subordinate revenue officers; and in this manner the protection of the forests will be more efficient, and the time of forest officers will be saved.

**Forest Officers not to go to head-quarters for their monthly accounts.**

272. The next point is, that an arrangement must be devised which will make it possible for the district forest officer to remain in the forests continuously during December, January, February, March, and April, without having to go to head-quarters at the close of every month to make up his accounts. This may be done in different ways, which I will briefly indicate. The accounts of two or three months may be clubbed together into one. In this manner, the accounts for December, January, and February might be amalgamated, one instead of three accounts being prepared for those months. March, being the last month of the financial year, would have to be kept separate, as it must be punctually rendered, and as an accumulation of accounts at the close of the year in the Comptroller General's office would be inconvenient. Another plan would be to incorporate the accounts of several divisions in one monthly account, as is done in the Tenasserim Circle, where the officer in charge of the Salween river and the Kadoe Revenue Station incorporates in his monthly account the accounts of the Salween, Thoungyeen, and Attaran divisions. The Rangoon Timber Depôt and Agency Office might prepare and render the accounts of all other divisions in the Pegu Circle. This would require the re-establishment of a central office of accounts at Rangoon, such as existed in the Conservator's office under the old system of accounts. Or again, all disbursements might be made, and payments on account of revenue might be received, by the Deputy Commissioner's office. In this case, a responsible Accountant for forests would have to be attached to the Deputy Commissioner's office in each district, and the Deputy Commissioner would be responsible for and sign the monthly accounts.

It will suffice to submit these general suggestions on the present occasion. No definite proposals can yet be made, and the matter requires further consideration. But so much is certain, that the present plan, under which divisional forest officers have to go to head-quarters once a month in order to close their accounts, seriously interferes with the progress of forest work and must be altered At first sight the simplest plan would seem to be that the office should accompany the divisional forest officer's camp. This, however, is not feasible in Burma, on account of the absence of roads and the difficulty

of procuring the needful carriage. Moreover, in many cases work has to be attended to at head-quarters while divisional officers are absent in the forests, and it is found convenient to have the office at head-quarters throughout the year for this purpose.

Some other expedient, therefore, must be devised in order to remedy the present practice.

### Communications.

273. One of the chief obstacles to rapid progress in the improvement of forest administration in Burma is the difficulty of locomotion and the time which is lost in moving about from place to place. The hills where the teak grows are difficult to travel over. The numerous steep ascents and descents are trying in the tropical climate of Burma; but besides this, the tracks—for there are no roads through the forests—lead frequently up and down the rocky beds of streams, in which deep pools of water, boulders and barriers of rock, fallen trees and quicksands, present themselves at every turn and form an ever-varying succession of obstacles to rapid progress.

### Roads in the open country.

274. Matters are not much better in the plains. In some districts an attempt has been made to clear and keep open tracks from village to village, and to prevent these tracks from being ploughed up and converted into paddy-fields during the monsoon. But these attempts are not very popular with the people, and they have in many cases been abandoned. In the dry season, after the paddy has been reaped, the paths run straight across the fields, and locomotion is easy; but in the rains it is very slow work getting from one place to another. Paddy-fields have to be circumvented by circuitous routes through the forest, and elephants and ponies have to work their way through the deep and soft mud, where every step involves the exertion of pulling out the leg from the heavy mud, which is often knee-deep.

In the plains the forest officers are only interested in a few lines of road which are required to reach the forests from stations, from the river, or from the line of rail; and it is much to be hoped that these lines, which at the same time are important for the country generally, will be improved. Many of the present feeder roads of the Irawaddy Valley State Railway exist in name, but are very little used by the people. Embankments have been thrown up, and there are bridges; but the bridges frequently stand isolated and are separated from the embankment, because the approaches have been washed away. Carts and other traffic follow the old meandering tracks. This will doubtless be improved in time, and all that I desire to urge on the present occasion is, that special attention be paid to those lines which are required to get to the forests from the railway or from the main rivers.

### In the forests.

275. In the forests themselves something has been done in places to improve the lines of communication and to facilitate travelling. The large increase of late years in the export of bamboos has done much to open out certain forest tracts, especially those situated in the vicinity of the open country. But the interior of most forests is as difficult of access as ever. Here road-making in the proper sense of the term is out of the question. Much, however, can and ought to be done by selecting the best lines and improving them by blasting rocks, cutting fallen trees, and clearing other obstructions. I fully admit the difficulty of the task. The flowering and seeding of any of the many gregarious bamboos, such as kyathoung-wa and tin-wa, obstructs and often closes all paths over large extents of country by the falling of the bamboo stems one over the other. Storms, such as the cyclone of April 1860, throw down all large trees over wide stretches of country, blocking up every road through it. Streams cleared this year become filled with fallen trees and drift wood the next; rest-houses are demolished by wild elephants, or are destroyed by the jungle fires. In short, the

undertaking to make the forests accessible presents as many difficulties as can well be imagined.

**Measures recommended.**

276. But the task has hardly yet been attempted with that determination to succeed which it deserves. That want of continuity, which is a real difficulty in so many public matters in India, has here also been the chief obstacle to progress. Paths are cleared and then abandoned. Easy lines of communication are discovered and described in reports, and are afterwards forgotten. The following is an extract from paragraph 25 of Mr. Leeds' Report for 1863-64, regarding an easy road from the Tharawaddy district to the Upper Zamayee forests, which probably has not been utilized as it ought to have been:

It may be of service to some who may have occasion to cross the Yoma to and from the Upper Zamayee to know of an easy pass. I therefore extract from Lieutenant Seaton's Report the route taken by him when returning to Tharawaddy from the Upper Zamayee, after his second visit to the forests in that district. "It was ascertained that the "Karens were in the habit of crossing the Yoma range of hills at the upper part of the "Kyetpyoo choung, a tributary of the Gamoong stream. The reports of it were so favour- "able that on returning to the west side of the Yoma this route was taken. The Sing "choung was ascended without difficulty to a little above the Saga-wah, a distance of two and "three-quarter miles above the Goke choung, both feeders on the east side. At this point one "short slope, with a very gentle ascent to the west, led to the crest of the main ridge of the "Yoma. On the west side a gradual descent of 500 feet was found to lead into the Kyetpyoo "choung. Along the bed of this stream the whole passage is clear for elephants and ponies, "except in two places, where a low slope to one side has to be crossed in order to avoid an "abrupt descent into the bed of the stream. From the mouth of the Kyetpyoo choung the "whole length of the stream is practicable for ponies and elephants. The Kyetpyoo choung "Pass appears more practicable and easy than any yet known."

This instance is mentioned in order to illustrate the advantages of recording detailed information of this kind in annual reports, so as to prevent its being forgotten. In annual reports, however, such information can only be recorded in a brief and summary manner; and the place where the subject of communications in the forests should be treated in full detail is the descriptive account of blocks, suggested in the sixth chapter of this Report as the result of girdling operations and the valuation surveys to be made in connection therewith.

Certain convenient lines through each forest district, touching the principal and most conveniently situated encampment grounds, should be selected, cleared, and improved, and should be maintained in a practicable state.*

**Rest-houses.**

277. Something has been done to facilitate travelling by building rest-houses in the forests and on their outskirts. The steady extension of this work cannot be urged in sufficiently strong terms. Except at stations and in villages outside the forests, substantial buildings are not as a rule required. The Karen villages in the forests shift every few years, and as it is obviously in many cases convenient to locate the rest-house at such villages, the best plan will probably be to arrange with the tsokay of the tay to build a detached bamboo hut, well roofed, for the use of the forest officer, whenever the village is established at a new site. If this plan is steadily pursued, shelter will be provided at a trifling outlay in numerous places in the forests, and will be available at all seasons of the year.

**Communication on rivers—Steam launches.**

278. Sanction has been given to the construction for the Forest Department in Burma of two steam launches; one to be employed on the Salween and Attaran rivers, the other on the Pegu and Hline rivers and in the Delta. This measure will greatly tend to make the Department more efficient. It will save the time of officers, and may have the effect of making it possible to do with one superior officer less in the Tenasserim Circle.

* It is also for consideration, whether paths, fit for walking and riding, should not be made and maintained along the boundaries of the areas assigned to the Karens. Eventually such boundary paths will, I believe, be found necessary.

**Contractors.**

279. All forests which are not held under lease by private persons are now worked on Government account, the entire operations of extracting the timber being done by contractors. The trees are girdled by Government officers; all the rest of the work is done by contractors. The holders of such a contract may, within the district to which their contract relates, cut any girdled trees which have stood long enough to be sufficiently dry and light for floating. Scales of rates are fixed for timber of different sizes, when delivered at the Government Timber Depôt (generally Rangoon for the Pegu Circle, and Moulmein for the Tenasserim Circle). The contractors manage the carriage by land and the floating, and it is left to them to cut up the timber into such sizes as are most advantageous to them, the rates paid by Government being so fixed as to make it profitable for them to cut the timber into those shapes which sell at the most remunerative rates. This system was introduced in the whole of the Pegu forests in 1856. In those days no elephants were employed in dragging timber from the forests in Pegu, excepting a few in the Toungoo district, and the timber was chiefly extracted by means of buffaloes. The measures taken in 1856 attracted a number of foresters from Moulmein, who came across with their elephants, and gradually natives of Pegu also began to purchase elephants; so that now among an aggregate number of 72 contractors, who were employed in Pegu in 1878-79, scarcely any work without elephants, although for smaller logs buffaloes are still largely employed.

**Permit-holders.**

280. Contractors were not, however, always employed in working the Pegu forests. In 1860 it was thought that the extraction of timber would be stimulated if the parties who worked the forests had a greater interest in the timber extracted by them, than they could have if working under contract. Accordingly, permits were granted, giving permission to extract the timber girdled by Government, which became the property of the permit-holders on their paying certain rates per log. Such permits were granted as an experiment in the forests of the Sitang valley and in the Tenasserim forests; their duration was only one year, and all the permit-holders were natives of the country. In 1861 the principal European firms at Rangoon represented to Government that the forests ought to be thrown open to private enterprize, and the result of the orders passed by the Government of India on these representations was that in the forests west of the Irawaddy and in the Upper Salween forests long leases were issued, granting the holders permission to girdle; and that in all the other forests, with the exception of those of the Tharawaddy district, permits, in some cases for three in others for six years, were granted, under which the permit-holder, on payment of certain rates, became the proprietor of the timber extracted by him, being however limited in his operations to the timber girdled by Government. Repeated efforts were made on the part of the permit-holders to induce Government to grant them permission to girdle, on the plea that their self-interest was a sufficient guarantee that the forests would be treated with due regard to their preservation. These efforts, however, remained unsuccessful, and the conditions under which the permits were granted were maintained. But in 1872 it was discovered that in some of the more valuable forests of the Sitang valley, which had been worked under long permits since 1862, the local agents of the permit-holders had illicitly girdled teak on a very large scale. The permits were thereupon cancelled, and at the end of long and very troublesome legal proceedings, a portion of the timber thus illegally obtained was confiscated, and some of the guilty persons were convicted and punished.

**Permit system abandoned.**

281. This experience clearly demonstrated the fallacy of the opinion, which had been long maintained, and which had been defended with great eloquence, that the management of the forests in Burma could be safely left to private enterprize; and it was decided not to renew any of the leases or

permits which had been given. The result is that at the present time all forests are worked under contract. This experience has been gained at a heavy cost. In the preceding chapters of this Report it has been explained that the forests west of the Irawaddy river and the Upper Salween forests, which were worked by permit-holders, with the permission to girdle, during a period of twelve years, have been almost completely cleared out, and that many of the Sitang forests have been so over-worked that they will yield no timber for many years to come.

However, the cost of this experience may be expected to have the effect of ensuring the adoption of a sound policy in these matters in future. Of the contractors now employed in working the forests, the majority are Burmans, a smaller number are Karens, and a few are Chinese and natives of India.

**Number of contractors employed.**

282. The general principle is, to assign to each contractor only one forest district or part of a forest district. This principle is sound, and must be maintained. There are exceptional cases of men with unusual energy or capacity for business, and in such cases it may be desirable to entrust them with a larger area. But it is a painful experience that prosperous business of this kind is very short-lived in Burma. Burmans are habitually imprudent and not thrifty. An energetic and capable man may earn a considerable fortune; but even if he manages to keep it together, it is sure to disappear in the hands of his children. Karens are less self-indulgent and much more careful than Burmans; but even in the case of Karens, fortunes made in the timber trade do not last many generations. Things will doubtless improve in time, but under existing circumstances it is safer and in every way more satisfactory to employ a large number of smaller contractors than to entrust the business to a few men with large means. Everything in this business depends upon the personal qualifications of the contractor, his special skill, local knowledge and influence; and in the case of Burmans and Karens, this is better utilized by the forest officer dealing with each man direct, without the intervention of capitalists.

Thus in three of the larger forest districts in Tharawaddy, the number of contractors employed during the last three years was as follows:

| | 1876-77. | 1877-78. | 1878-79. |
|---|---|---|---|
| Toungnyo ... ... ... | 7 | 6 | 5 |
| Beeling ... ... ... | 3 | 5 | 5 |
| Boben ... ... ... | 4 | 7 | 6 |

**Gross earnings of contractors.**

283. The quantity of timber extracted and the gross amount earned by each contractor will appear from the following figures:

| Division. | Year. | Number of contractors. | Timber brought out. | Amount paid to contractors. |
|---|---|---|---|---|
| | | | Logs. | Rs. |
| Prome ... ... | 1876-77 ... | 4 | 2,572 | 34,512 |
| | 1877-78 ... | 6 | 4,531 | 75,889 |
| | 1878-79 ... | 7 | 987 | 11,520 |
| Tharawaddy ... ... | 1876-77 ... | 26 | 7,295 | 78,472 |
| | 1877-78 ... | 26 | 9,636 | 99,029 |
| | 1878-79 ... | 25 | 6,400 | 62,712 |
| Rangoon ... ... | 1876-77 ... | 3 | 2,173 | 27,848 |
| | 1877-78 ... | 2 | 1,570 | 16,055 |
| | 1878-79 ... | 2 | 301 | 2,623 |

The number of elephants employed by contractors in 1878-79 was—

| | | | | |
|---|---|---|---|---|
| In Prome | ... | ... | ... | 7 |
| In Tharawaddy | ... | ... | ... | 93 |
| In Rangoon | ... | ... | | 7 |

The average gross earnings of one firm during the three years to which these figures relate was in the Prome division Rs. 7,170, in the Tharawaddy division Rs. 3,120, and in the Rangoon division Rs. 6,646 a year. In a few cases only did the gross annual earnings exceed Rs. 10,000, viz.,—

| | | | | Rs. |
|---|---|---|---|---|
| Prome, | 1876-77, Moung Engyke, Karen, | Mindoon forest | ... | 19,057 |
| Do., | 1877-78, ditto | ditto | ... | 59,377 |
| Do., | 1876-77, Shwaybyoo, Burman, | Nawing forest | ... | 15,146 |
| Do., | 1877-78, ditto | ditto | ... | 14,901 |
| Tharawaddy, | 1876-77, Moung Tsanthla, Burman, | Gamoong forest | | 12,149 |
| Do., | 1877-78, ditto | ditto | ... | 14,871 |
| Do., | 1877-78, Moung Lewin, Burman, | Shwaylay forest | ... | 17,604 |
| Do., | 1878-79, ditto | ditto | ... | 10,939 |
| Rangoon, | 1876-77, Moung Myat Nay, Karen, | Pegu forest | ... | 11,573 |
| Do., | 1876-77, Mong Engyke, Karen, | Zamayee forest | ... | 11,326 |

**Necessity of resuming girdling operations.**

284. The earnings of the contractors have diminished considerably during the last few years, as the good timber became scarce through the suspension of girdling operations. This will be understood if it is considered that while the annual yield of the Burma forests in teak timber averaged 43,735 tons during the five years from 1874-75 to 1878-79, the yield of 1879-80 came down to 17,585 tons.

One consequence of this diminished yield has been that some contractors have gone to seek employment beyond the frontier, in Burma Proper, and that others have sold their elephants. This is the chief reason why girdling operations could no longer be deferred. It was necessary to suspend these operations during the period from 1876 to 1879, in order to make the services of all officers available for the work of demarcation. The steady progress of demarcation is now assured, and the girdling operations, which were re-commenced in 1880, must now again be steadily continued within the limits and with the precautions suggested in the preceding chapter. An efficient staff of contractors for the working of the forests is as important for the satisfactory progress of forest administration in Burma as the maintenance of an efficient staff of officers and subordinates.

These reasons for increasing the girdled timber in the forests are felt most strongly in the Pegu Circle. In Tenasserim there is less risk in delay, for it will probably not be difficult, whenever larger quantities are made available for extraction, to induce foresters to come into British territory from Siam and the Karennee country.

In Pegu, also, I am of opinion that, as soon as the prospects of work improve, some of the foresters will return; but the extensive and rich forests in Burma Proper and on the Irawaddy and Sitang rivers will always give employment to a large number.

**Organization of Staff.**

285. If the work sketched in the preceding portions of this Report is to be accomplished in a satisfactory manner, the following staff of superior officers will be necessary:

I. *Pegu Circle.*—One district forest officer for each of the seven districts; two assistants for Tharawaddy; and one for each of the four districts—Thayetmyo, Prome, Toungoo, and Rangoon: total thirteen officers. These assistants are required mainly to attend to the girdling and cultural operations, as explained in a previous chapter.

II. *Tenasserim Circle.*—One district forest officer for the Salween; one for the Mergui; and three for the Amherst district, viz., Kadoe Revenue Station, Thoungyeen, and Attaran: total five officers.

III. *Demarcation Staff.*—Four officers.

In addition to these, one officer of the Burma staff is employed in Arakan.

Thus the total number required under the two Conservators is 23 officers. Of this number, the four proposed for the demarcation staff may be considered as temporary, although they are certain to be required during the next ten years, and probably longer. Should the alteration suggested in the limits of the Thayet and Prome civil districts be made, it will be possible to do with one officer less. In this allotment no provision is made for supernumeraries.

The scale of officers under the two Conservators sanctioned at present stands as follows:

| | Officers. |
|---|---|
| Deputy Conservators ... ... | ... 7 |
| Assistant ditto ... ... | ... 7 |
| Sub-Assistant ditto ... ... | ... 4 |
| Total | ... 18 |

The deficiency will probably be most economically supplied by increasing the number of Sub-Assistant Conservators. The difficulty, however, arises that under existing circumstances these additional appointments, if made, cannot be filled for a considerable time to come. No Forest Rangers in Burma are at present ready for promotion to the class of Sub-Assistant Conservator. There is one Probationer, but it will take years before these new proposed appointments can be filled in a satisfactory manner.

**Operations must be contracted until the Staff has been completed.**

286. Therefore, until the staff as here sketched can be completed, nothing remains but to limit the work to what can be done in a satisfactory manner. Broadly speaking, it may be said that the work of demarcation must take precedence of all other work; and that if sufficient officers are not available to do justice to the selection of trees to be girdled in the reserved forests and to the examination of the forests, as sketched in Chapter VI. of this Report, then this work must remain in abeyance in those districts in which competent officers are not available.

Outside the reserved forests girdling operations do not require the same care as in the reserves, and very likely it will be necessary, during the next few years and until the staff has been completed, to rely upon the trees girdled outside the reserves for the annual supply of timber even to a greater extent than is contemplated in this Report.

The leading principle in forest administration in Burma should be, not to attempt any work for which competent officers are not available, and rather to contract operations than to undertake work in the forests which cannot be carried through in a satisfactory manner.

**Staff of Forest Officers how to be recruited in Burma.**

287. Hence it will be clear that the growth of the forest revenue, as well as the progress made in the improvement of the forests, will be much influenced by the measures that may be taken to complete the superior staff of the Forest Department in Burma. The success of those measures will, as already stated, to a great extent depend upon the efforts that will be made to recruit the staff of Forest Rangers by the appointment of educated young men, Burmans or Karens, who may afterwards be fit for promotion to the class of Sub-Assistant Conservator. The difficulty is that educated youths, Burmans or Karens, are even more liable to suffer from fever in the forests than young Englishmen fresh from home.

Hence forest service is not as yet popular among the educated natives of Burma. Moreover, at the present time, a young man who knows English, and has otherwise received a fair school education, can always command remunerative employment either in Government or in private employ. But as education becomes more general, the facility of finding employment will diminish; and eventually it may reasonably be expected that the present scarcity of suitable candidates, strong enough to stand the life in the forests, will gradually disappear.

# PART SECOND.——Special.

## CHAPTER VIII.

### KYETPYOOGAN.

288. Inspecting the plantation on the 8th January, the chief point which forced itself upon my attention was the great difference in the condition of the plants on the high ground in the western portion and on the low ground on the east side. The plantation was formed during the four years from 1868 to 1871, but the age of the plants has had much less effect upon their present condition than soil and locality.

#### 1868.

289. The plantation of 1868, which occupies 35 acres of low ground on the east side, is worse stocked, and the plants are smaller than any of the more recent plantings. The teak looks unhealthy, many plants have died, and the ground is now chiefly occupied by grass and other kinds of trees. The teak trees which have survived are very unequal in size, and it is not possible to form any idea regarding the average height, but they are all smaller than those on the better stocked portions of 1870 and 1871.

#### 1869.

290. The plantation of 1869 occupies 145 acres in the centre and on the east side, and the north-eastern part of this area is as bad as the block of 1868. It is better further west, where the ground rises, and in the southern part, where the ground is drained by ditches and ravines. In the better portions the cover is complete; the grass has been killed out; and the trees average 30 feet in height, with a girth of ten inches. This is the result of measurements taken in February 1879. It is estimated that about one-half of the area of 1869 is well stocked, the other half consisting of scattered teak trees, with a great deal of grass and a few trees of other kinds.

#### 1870.

291. The plantation of 1870 was made in two separate blocks—the smaller one south of the block of 1868 and at the back of the village, and the larger on rising ground on the west side of the plantation. The area planted in that year was 147¼ acres. The whole of this year's planting is good, with little exception. The measurements taken in February 1879 gave 800 trees to the acre, with an average height of 30 feet and girth of 9½ inches; and in addition to this there is the growth of last rains, which has been good. The present average annual increase in height of this part of the plantation may be put down at from three to four feet. The cover is nearly complete, and there is very little grass on the ground. The fires which have passed through it during the last three years have consequently done little damage; and in places I noticed an accumulation of leaves on the ground more than one year old, which showed that some patches were self-protected. A portion of the trees have commenced to seed, and the formation of the terminal shoot and branches is not altogether satisfactory. Many stems are forked, and the end branches are wavy and crooked. I do not think that the growth in length has terminated, but we cannot expect that very long timber will here be produced. The leaves also are much smaller than at Magayee.

#### 1871.

292. The plantation of 1871 aggregates 356 acres, and is in two blocks at the north-west and south-east ends. A narrow belt on the rising ground is good, and here the trees are nearly as high as those of 1870. The eastern portion, on low ground in the northern block, is very poor, and is

similar to the plantation of 1868 and the eastern part of 1869. In February 1879 measurements were taken in the southern block, which gave 876 trees to the acre, with an average height of 20 feet and a girth of 8½ inches.

**Insects.**

293. The Kyetpyoogan plantation has suffered considerably from insects and fires. Caterpillars first appeared in the summer of 1874, but did not do much damage. In 1875 they began their ravages early in May. The young leaves were all eaten, the trees were bare of leaves, and many trees were killed. This continued until July. In 1876, 1877, and 1878 the plantation was attacked, but the damage was less, as the caterpillars were only at work from about the middle of May until the middle of June. The caterpillar at work in these three years was identified as belonging to the family of the *Tortrices*, but the species has not been determined. In 1879 the leaves were partially eaten, but the insect was not seen. The borer has not been noticed in Kyetpyoogan.

**Fires.**

294. During the first years the plantation was protected from fire without much difficulty, as there were always labourers on the spot for planting and weeding, which facilitated protection. In 1875 the first large fire occurred. In 1876 the plantation was successfully protected, with the exception of about ten acres; but in the hot seasons of 1877, 1878, and 1879 fires swept through the plantation. The fires of 1877 and 1878 originated in toungyas cut near the boundary. In 1879 the fire was due to the carelessness of the contractor who was employed in clearing the fire-traces. The fire of 1875 was lit maliciously by Shans, out of spite against the contractor who had purchased the thatching grass.

**Measures taken to ensure fire protection.**

295. The measures taken in order to ensure protection from fire in future have been as follows: On the east side, where the Prome Road forms the boundary, the space between it and the road has been cleared, all large trees being left standing, and grass and jungle have been burnt. East of the road are chiefly gardens; so that no danger is apprehended from that side. On the other three sides a safety belt, 100 feet wide, has been cleared and will be burnt. On a portion of the west side, where the boundary is formed by ravines and evergreen forest, a narrow belt is sufficient.

**Inner Lines.**

296. Two rides 42 feet broad, running east and west, have been cut and burnt through the whole width of the plantation. These rides separate the plantation into three isolated blocks. In addition to this, the whole plantation is traversed by a system of twelve-foot roads. Some of these roads and other blank spots in the plantation are stocked with good thatching grass. Instead of selling this grass to a contractor, a notification has been issued permitting the people in the vicinity to take it away, and several hundred cart-loads of grass have already been removed this season. This seems a good plan, and it is expected that by this arrangement most of the thatching grass in the badly stocked portions will be removed, while in the better stocked portions the cover overhead is sufficient to keep the ground clear. To employ labour for the cutting of grass on these numerous roads and on blanks would be too expensive, and is hoped will not be necessary.

The risk of fire in Kyetpyoogan is of two kinds. The risk from fires that may be lighted inside the forest can only be guarded against by the vigilance of the establishment, and by securing the good-will of the people in the vicinity. The risk of fire entering the plantation from the outside can be prevented; and, although the arrangements already made are good, I am of opinion that something more requires to be done.

**Addition of an outer belt round the Plantation.**

297. I am inclined to recommend that an area on the north, south, and west sides of the plantation be made over to the Forest Department, and be enclosed by a cleared boundary line and by suitable boundary marks. There is no occupied land in the immediate vicinity of the plantation, and should any rights be found to exist in the land proposed to be taken up, they must either be purchased or be permitted to continue. The outer boundary lines should, of course, be as straight as circumstances will permit. On the east of the Prome Road no addition to the area is recommended.

The advantage of this measure is two-fold : fresh toungyas cannot be cleared in this outer belt, and it will be possible to fire the forest, which will then surround the plantation, at such time as may be most convenient. Kyetpyoogan is outside the limit of the Forest Rules of 1865, and in order to obtain a good title it may be found convenient to acquire the land under the Land Acquisition Act. The area originally reserved for the purpose of the Kyetpyoogan plantation was 1,754 acres, of which 683 acres have been planted up. The excess over the area planted with teak has never been formally abandoned, though no care was taken to guard against encroachments and against the cutting and burning of the forest for toungyas and gardens. The difficulty hitherto experienced in protecting the plantation from fire must, to a great extent, be attributed to the want of care in maintaining control over the entire area, and the suggestions now submitted are intended to remedy this defect.

**Future Treatment.**

298. Regarding the future treatment of this plantation and its financial prospects, it will suffice to say that out of the 683 acres about 400 acres are well stocked, and here thinnings would doubtless be useful. The process of natural selection and the development of the dominant trees has progressed in a satisfactory manner, but this process would certainly be accelerated by thinnings. On the other hand, thinning will be expensive, for the poles that may be cut out are not yet large enough to fetch remunerative prices. The trees cut on the internal fire lines have not yet been sold, and will probably not be sold except at very low rates.

Nor would thinnings be an unmixed advantage, for every tree cut diminishes the cover, and by admitting more light must tend to increase the growth of grass. On the rising ground and in the better stocked portions it may reasonably be expected that the cover will, after a few years, be as thick as before. Nevertheless, it will, under these circumstances, be well to wait a few years before commencing thinnings on a large scale. Nothing can be done in the badly stocked portion, which is estimated to cover 283 acres, except to improve it by continued protection from fire. In part of this area teak will probably give way to other trees, and the result will be a mixed forest with a varying proportion of teak.

But as long as fires continue, grass will retain the upper hand, and no improvement of any kind can possibly be expected.

**Prospect of Revenue.**

299. By the addition of the outer belt as here recommended, it is hoped that the total area of this Government estate may be increased to about 1,500 acres; and, although at first it will be necessary annually to burn the forest which will form the new addition, it will doubtless be possible a few years hence to protect this also from fire; and then, when this forest has improved, some revenue may be made by the sale of firewood and charcoal. Charcoal at present fetches from Rs. 20 to 70 per 100 baskets according to the season, and the price is not likely to diminish. If protected from fire, the outer belt may also be expected to improve by the springing up of self-sown seedlings from the trees in the plantation.

I purposely abstain from entering into any calculations regarding the possible yield of this plantation. The outlay up to the 31st March 1880 has

been Rs. 76,823, and some annual outlay will be necessary for some time to come. Four fire-watchers will be required for four months, which at the rate of Rs. 60 per man will entail an outlay of Rs. 240 a year. Clearing and burning of fire-traces and rides will, after the current year, require about Rs. 800 more; so that the total annual cost will be about Rs. 1,000.

**Object in maintaining the Plantation.**

300. Considering the poor state of a portion of this plantation, the question naturally arises whether it would not be better to abandon it altogether. This, however, I am decidedly of opinion should not be done. The plantation was established with the definite object of ascertaining whether teak might advantageously be cultivated in the vicinity of Rangoon, where thinnings and small timber were expected to be saleable at better rates than further inland in the real home of the teak tree. There can be no doubt that the expectations entertained regarding the success of this plantation in 1868 will not be fulfilled, but it is necessary to give this experiment a fair trial and to carry it on to the end, so that no doubt may remain on the subject.

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## CHAPTER IX.

### MAGAYEE

**Magayee plantation.**

301. The Magayee plantation was commenced in 1872, after the work at Kyetpyoogan had been closed. The planted blocks occupy a narrow belt about eight miles long, stretching from west to east, from the railway to the foot of the hills, and they aggregate 1,347 acres. The six oldest blocks are on the west side, and the soil here is much less suited to the growth of teak than the land further east at the foot of the hills, where the more recent plantations have been made.

**Soil—Western portion.**

302. Following the road from the forest rest-house near the railway, we first passed through one of the two blocks of 1873. These two blocks are surrounded on all sides by Eng forest (*Dipterocarpus tuberculatus*), but contiguous to the western block is a considerable stretch of forest in which the *dipterocarpus* is mixed with Myouk-shaw (*Homalium tomentosum*), Pyinkado (*Xylia dolabriformis*), teak, and other trees, indicating lighter soil than is generally found in the eng forest. In this locality the soil is rich, and the trees, particularly those of eng, have attained an unusually large size. The natural teak also, though the stems are not quite cylindrical, has a good stature and will doubtless yield marketable logs, provided fires are kept out and the trees are allowed to attain a sufficient size. The locality selected for these two blocks is probably the best that could be chosen in this part of the forest, and in the immediate vicinity of the railway line. The plantation of 1872 is situated on both sides of the Magayee stream; the soil is similar, the subsoil being a stiff clay, such as is usually found in eng forest, but it is overlaid by accumulations of sand, which at one time or other have been brought down by the river. The two western blocks of 1874, which are situated on the south bank of the Magayee river, have a similar soil.

**Soil—Eastern portion.**

303. The limit of the eng forest is between the two blocks of 1874, and hence the eastern block of that year, as well as the two blocks of 1875 and the large blocks of 1876 and 1877, are on soil very different from that of the five western blocks. The soil most suitable for the growth of teak is found in the blocks of 1876 and 1877. At the eastern end of the latter block

the rock crops up, being a hard ferrugineous sandstone and conglomerate, such as is commonly found in this part of the Pegu Yoma. In other places I am informed that grey shale is found near the surface. The soil is sandy, and there is no stratum of clay. The eastern block of 1874 and the two blocks of 1875 are at a greater distance from the hills, and the soil is not as favourable for the growth of teak as in the two blocks just mentioned.

These remarks will have made it clear that there is a great difference in the conditions for the growth of teak in the eastern and western portions of the plantation, the conditions being most favourable in the blocks of 1876 and 1877, and least favourable in the area planted in 1873. There is, however, no part of the plantation as unsatisfactory as the east side of Kyetpyoogan.

**Rate of growth.**

304. The most remarkable feature in this plantation noticed at the time of our visit, in January 1880, was the great length of the shoots of 1879. In the lower or western blocks the shoots of that season were considerably longer than three feet, and in the blocks of 1876 and 1877 we measured some shoots ten feet long. In this respect the appearance of the Magayee plantation contrasts most favourably with Kyetpyoogan. In February 1879 measurements were taken in order to determine the average height and girth of the trees, with the following results:

| Year of planting. | Number of trees per acre. | Girth. | Height. |
|---|---|---|---|
| | | Inches. | Feet. |
| 1872 ... ... ... | 1,100 | 10 | 26 |
| 1873 ... ... ... | 1,084 | 6 | 18 |
| 1874 ... ... ... | 952 | 6 | 18 |
| 1875 ... ... ... | 1,059 | 8 | 20 |

At the time of our visit the average height of the trees of these four years was considerably greater. In one of the better stocked portions of 1872, near the Magayee choung, the average height of the trees was over 30 feet.

**General condition of growing stock.**

305. The whole of the planting was done at equal distances, 6 × 6 feet, and the present state of the growing stock may briefly be described as follows.

The blocks of 1873 are completely stocked throughout, and the grass has been almost entirely killed; the leaves are large, and the plants look exceedingly healthy, although the trees have a tendency to branch, and the terminal shoots are less prominent than in the other blocks.

The block of 1872 is traversed by stretches of low ground, where the teak has almost died out, and the kaing grass is very luxuriant. In this block, north of the Magayee stream, and on the east side of the old main road, an area of three acres was planted with kyathoung-wa, mixed with teak. The bamboo has overtopped the teak, and where it stands thick has killed a number of trees. In some places the teak has been drawn up to a great height, and is not likely to suffer; but so much is clear that this bamboo must not be planted simultaneously with teak. The rest of the block is well stocked, and the trees have an excellent appearance.

In a portion of 1874 teak was mixed with thitkadoe and sappan, both of which have failed almost entirely. The blanks were filled up with teak

transplants, but upon the whole it must be said that the area planted in that year is more imperfectly stocked than the plantations of other years. In all three blocks there is a good deal of grass, and in block 2, which was originally partly stocked with thaik-wa, the bamboo has in places overtopped the teak.

In 1875 teak was mixed with thitka, thitkadoe, and padouk; but of these kinds a few trees only are left. These blocks have not been very successful, large portions being imperfectly stocked, with a great deal of high grass. In the better stocked portions, however, the grass is beginning to die out.

The two blocks of 1876 and 1877 are very satisfactory, and the difference between the plants of these two years is not considerable. Throughout the large block planted in these two years, which measures 595 acres, the teak trees have overtopped the grass in most places; and although the grass is still very thick and luxuriant, there is every prospect that in another year it will commence to disappear. The highest plants measured by us were 22 feet high in the plantation of 1876, and 18 feet in that of 1877. In 1876 the teak was mixed with pymma, which has come up, but which in all probability will be overtopped, the plants being much smaller than those of teak.

**Outlay.**

306. The total area of these plantations now aggregates 1,347 acres, upon which Rs. 1,15,023 have been spent to the close of 1879-80, being at the rate of Rs. 85 per acre. The following statement shows the outlay of each year, together with the area planted during the year. It includes charges for maintenance as well as for extensions :

| Year. | Area planted. | Expenditure. |
|---|---|---|
| | Acres. | Rs. |
| 1872-73 ... ... ... ... | 142 | 10,048 |
| 1873-74 ... ... ... ... | 213 | 15,759 |
| 1874-75 ... ... ... ... | 206 | 9,904 |
| 1875-76 ... ... ... ... | 150 | 17,884 |
| 1876-77 ... ... ... ... | 322 | 21,979 |
| 1877-78 ... ... ... ... | 273 | 18,373 |
| 1878-79 ... .. ... ... | ... | 10,476 |
| 1879-80 ... ... ... ... | 41 | 10,600 |
| TOTAL . | 1,347 | 1,15,023 |

The outlay recorded in 1878-79 was incurred partly on maintenance, partly on road-making, partly in planting 30 acres with teak seed which was bad and did not come up, and partly on clearing for extension an area of some 200 acres, which, owing to the early rains of 1879, could not be burnt. The additional area of 41 acres entered in 1879-80 consists of a belt on the western boundary 100 feet broad, near the railway line, planted with mango, jack, Toung-thaleh (*Garcinia*), Gan-gaw (*Mesua ferrea*), and other evergreen trees, in order to facilitate protection against fire.

**Experiments.**

307. In the above return is included the outlay incurred upon miscellaneous experiments undertaken prior to 1876. It is estimated that the cost of these experiments has aggregated Rs. 10,000, but they have almost all ended in failure.

The chief object was to cultivate caoutchouc-yielding trees, to produce silk and lac, and to try exotic trees generally. In 1874 Mr. Strettell brought down, from his deputation to the caoutchouc forests of Mogoung in Upper Burma, 124 plants of *Ficus elastica*, which were all planted at Magayee.

They were mostly put out in the midst of a shady part of the forest, and here very few survive. It was not then known that the *Ficus elastica* requires much light for its vigorous development. Fortunately, some 50 plants were put out in the open; and of these the Report for 1879-80 says that they average 10½ feet in height by six inches in girth, the largest, six years old, measuring 20 feet in height and one foot in girth. This is good growth, but much less rapid than at the Charduar caoutchouc plantation in Assam. In that locality plants three years old are 15 feet high on an average, and plants five years old attain a height of 25 feet, while in Magayee plants six years old average only 10½ feet. It would however be premature to pronounce definitively regarding the probable success of *Ficus elastica* at Magayee.

It must be remembered that the climate of Magayee differs widely from that of the Darrang district in Assam. The mean annual rainfall is about the same, but the temperature is much higher in Magayee in latitude 17° 30′ than in Charduar in latitude 26° 30′. The long hot dry season of Lower Pegu is doubtless the greatest obstacle to the success of the plants. The tree, however, thrives at Rangoon; and though the growth in Pegu may be less rapid than in Assam, the yield of India-rubber may nevertheless be good. Regarding this last subject, however, we as yet know nothing.

In addition to those brought from Mogoung, some 900 plants were raised from seed brought from Assam. They were not, however, watered as those brought from Mogoung; many of them were also eaten by deer, and only a few plants are now alive. I do not recommend a renewal of this experiment until it is ascertained how the *Ficus elastica* plants in the open may succeed.

From the Report for 1879-80 it appears that arrangements have been made to put out such plants as are now under shade, and are not too large for transplanting, in a belt of kaing grass near the river; but they must be planted on raised mounds, and it will be necessary to fence them round. A considerable number of plants of a creeper belonging to the family of the *Apocyneæ*, cultivated in gardens near Rangoon on account of its edible fruit, *Chavannesia esculenta*, have been planted. The creeper produces caoutchouc, and experience must shew whether it will be profitable. No experiments with American or African caoutchouc trees have as yet been made at Magayee.

The experiments made with the tasar silk-worm from India have been a failure. For the production of lac, species of *Croton*, *Zizyphus*, and other kinds were planted, but there has been no result. A few plants of the Vanille are cultivated at Magayee. They are thriving, have flowered this season, and have set pods.

Of late years the Rain-tree (*Pithecolobium Saman*) has been planted along the roads. The plants seem to succeed, but have not made as good growth as those planted at Prome and in the Tharawaddy district. Mahogany trees have also been raised and planted out, and the experiment with this tree ought to be continued systematically. The tree thrives well and produces excellent timber in the vicinity of Calcutta, where trees, 80 years old, have been sold for Rs. 1,000 a tree.

### Fire Protection.

308. The great difficulty in Magayee, as in Kyetpyoogan, is the protection against fire. Hitherto each block has been protected separately, a 50-foot line having been cleared on the outside. This year, for the first time, a new system has been adopted, of surrounding by fire-traces the entire belt of forest in which these plantations are enclosed. This will protect from fire an area of about 3,000 acres, at a slightly higher cost than is at present expended upon 1,300 acres. The outer fire-line consists of a broad belt, cleared of all grass and underwood, the larger trees having been left standing. On the west side, near the railway, this clearance is 100 feet, and on the other sides it is 30 feet wide. Besides the outer lines, a number of interior lines, following roads wherever possible, have been cleared in the same manner, with the view of isolating each block. The large block planted in 1876 and 1877 has been traversed by three lines, 30 feet wide, which cross at a point in the centre. As soon as the grass outside the outer fire-lines is dry it is intended to burn it. On the west side, near the railway line, a length of three miles has, as already mentioned, been planted on the

outer boundary with evergreen trees at distances of 6×6 feet. These plants are succeeding well, and the shade of the trees left standing on the clearances is not likely to impede their growth, as these trees grow best under shade. On some of the interior lines it is proposed to plant Gan-gaw (*Mesua ferrea*), other evergreen trees, and a succulent plant (*Bryophyllum*) which is often cultivated by Burmans round pine-apple gardens at Rangoon.

The success of these measures, as regards preventing the entry of fire from the outside, will chiefly depend upon the successful burning of the grass outside the boundary fire-trace. Here the grass should be burnt as early as possible; and in order to facilitate burning, it will be necessary either to beat down the grass or to traverse it by a system of narrow cut traces in the form of a ladder.

Against fires which may be lit inside the protected area nothing but vigilance and a sufficient staff of fire-watchers will avail. Unfortunately, the shape of the plantation being a narrow belt, eight miles long, protection will always be difficult and the outlay heavy; but there is no doubt that the risk and cost will diminish as the grass in the plantations disappears, and as the cover in the surrounding protected forest becomes thicker, whereby the grass under the trees will diminish.

**Thinning and extension.**

309. As regards thinning in this plantation, we have, after carefully considering the question on the spot, come to the conclusion that this operation is not required at present: the process of natural selection has been satisfactory, and the dominant trees are well marked in most blocks.

310. As regards extension, an area has been selected by the Conservator, situated at the foot of the hills north of the plantation of 1877. In this area it has been proposed to plant five blocks, each measuring 200 acres, of which it was supposed that 150 would be selected for planting up, the whole of the lower portions being left out. According to this plan, there would be five years more work at Magayee. I am inclined to advocate that two blocks, where the forest was cut in 1879, be planted up, as far as this can conveniently be done; but that after this has been completed, planting operations in Magayee be suspended, in order to reduce expenditure and to save the time of the officer who would otherwise be required for the superintendence of the work. The chief argument against this proposal, and in favour of continuing planting operations during the next five years, is that after that period the lower blocks may be expected to be so completely under cover as to be safe from fire, and that until then the labourers employed in planting will be available for fire-protection. But there are weighty reasons against continuing the work at Magayee on a large scale at present. The place is unhealthy, and the supply of labour is uncertain. No labour is available on the spot, and all the men hitherto employed on the plantation have been Shans, brought to the place and settled there by the Forest Department. Nor has it hitherto been found easy to obtain and retain the services of these people. They dislike the place, because it is unhealthy and difficult of access, and there is no ready market for the crops raised by them. Early showers often occur during the hot season, and they not rarely frustrate the burning of the forest cut for planting. At all events, it seems better to suspend planting operations at Magayee for the present. This will necessitate special arrangements to ensure the protection against fire of the blocks already planted. I understand that it is considered necessary, in addition to the fire-watchers entertained during four months of the dry season, to have a staff of coolies ready on the spot for emergencies. Hitherto assistance in such cases has been given by the men employed at the plantation, and if the plantation is not extended, other employment must be found. For some years to come it will not be difficult to employ the staff of coolies required to assist in fire-protection in constructing a complete system of bridle-paths, so as to make all parts of the plantation readily accessible; and when this is completed, other work will doubtless be found. The nearest railway station is distant from the plantation and not easily accessible from it, though the line passes close to it. This is an additional difficulty, but there is prospect of a new and more conveniently situated station being established. If this is done, it will probably not be difficult to induce the Shans to settle

permanently in the vicinity, as they will then be able to send their produce to Rangoon; and if this is the case, operations might be re-commenced.

**Kimpadee plantation.**

311. It is here the place to mention the result of our visit to a small teak plantation made in 1865 by the Magayee Forester, near the Upper Kimpadee village. The state of this plantation in 1868 will be seen from the following extract* from my journal of the 4th January 1868:

*Saturday, 4th January* 1868.—Left camp at 7 A. M., and visited a teak plantation made in 1865 and about one acre in extent, formed in the neighbourhood of Kimpadee by the goung-way of the Magayee forest, Moung Tok Poh. This plantation was formed on ground previously covered with clumps of bamboo of the species Wa-pyoogalay, which was cut down and burnt preparatory to sowing the teak seed. In one part seed was sown in lines ten feet apart and at intervals of four feet within the lines. In the second portion the trees are transplants from the first portion. The trees standing in the portion sown are larger and finer than those transplanted. In the former instance they have attained a height varying from ten to twenty feet and a diameter from one to three inches. The shoots of the rains of 1867 are in many cases six feet and above, and the trees are straight and regular. Within the lines they have closed up to each other sufficiently, but not so between the lines. A few of the side branches have developed more than is desirable. In this part of the plantation the trees have on the whole got the upper hand of the under-growth, but the ground between the lines is covered with elephant grass, which may endanger the safety of the young trees by catching fire. The elephant grass is not, however, likely to impede their growth, but will, on the contrary, keep the ground moist. A few bamboos have sprung up. Fires seem to have passed through this part of the plantation, and some of the trees appear to have been burnt down once or twice. In the southern part of the plantation, which consists mainly of transplants, the young trees are much smaller and weaker, and their growth much impeded by the elephant grass which has sprung up and overtopped them. Most of them seem to have been burnt down several times. Some trees have been broken down by elephants. Soil, dark sandy loam. The principal work required to be done to this plantation is to clear a good space round it to protect it from fire.

On our present visit all dominant trees were measured in the main portion of the plantation, which covers about three-fourths of an acre, with the following result:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Number of dominant trees per acre | | | | ... | ... | 430 | |
| Average height of dominant trees | | | ... | | ... | 48½ | feet. |
| Ditto girth | do. | do. | ... | ... | ... | 16 | inches. |
| Tallest tree | do. | do. | .. | ... | ... | 56 | feet. |
| Largest girth | do. | do. | ... | ... | ... | 27 | inches. |
| Smallest girth | do. | do. | ... | ... | ... | 10 | inches. |

The plantation is now fifteen years old; the trees were planted in lines ten feet apart, and at intervals of four feet within the lines. It has never been thinned; nevertheless, the dominant trees are well marked and sturdy, shewing no signs of being drawn up too much. The plantation is surrounded by bamboos; under the teak trees there is no underwood, but a number of self-sown teak seedlings. This plantation has not been specially protected from fire, and of late years the fire has probably passed through it annually without having done much damage. The growth of the trees and the shape of the stems are excellent, but there is one feature which is not satisfactory, and this is that nearly all the trees have commenced to bear seed. The further progress of this plantation should be carefully watched, specially with reference to the question whether the trees which are now seed-bearing will again produce vigorous terminal shoots. The chief point to be learnt from the plantation is, that the plan of planting in lines ten feet apart with four feet between the plants in the lines answers well; and I recommend that when planting work is resumed in Magayee this arrangement be adopted.

The arrangement recommended gives 40 square feet for each plant, while the arrangement 6′ × 6′ gives 36 feet only. The advantage of planting in lines is that the plants which are naturally stronger have, during the first ten years of their life, sufficient side-room to expand and thereby to kill their weaker neighbours, and this favours the development of the dominant trees.

* Page 5 of the Journal appended to the Working Plan of 1868.

# CHAPTER X.

## THARAWADDY AND PROME.

### Thoonzai Forest.

312. The Thoonzai reserve comprises the basin of the Thoonzai river, from the Yoma to a line running in a south-south-easterly direction through Way village, with a bend inland south of Way, so as to exclude the paddy-fields of the Yabein villages of Way, Naymapyaw, Shwayloung-Gan, Kannee, and Thaywa, together with a considerable area of teak and bamboo forest.

On the 15th January we examined the ridge which runs north of Way village parallel with the Thoonzai river, and which is known under the name of the Pasatway Kyaw. On this ridge a large number of teak and other trees were marked in 1858. The girth of these trees was recorded and measured regularly once a year for several years, in order to determine the rate of growth of these trees. The marks are still traceable, but the record of measurements has been lost. We descended to the Thoonzai stream at the Kyoukaing, and returned by the road which leads from Tohdee tay to Way village. On the 16th we went to Tohdee tay, and, before entering the Koon Beeling district, passed through a large extent of undulating ground, which is drained by several tributaries of the Nat choung. This part of the Thoonzai forest contains a large number of young trees between 18 inches and 4 feet 6 inches in girth, and many of them tall and well-grown. These tracts were worked heavily before annexation, and I estimate the age of these trees at from 40 to 50 years. The following were measured as instances of average-sized trees:

| Girth. | | Height. |
|---|---|---|
| 40 inches | ... ... | 83 feet (55 feet to first branch). |
| 34 do. | ... ... | 79 do. |
| 39 do. | ... ... | 93 do. |

The shape of the stems is not as regular as in some forests; nevertheless, this portion of the outer Thoonzai forest is extremely valuable; and whenever it may be possible to bring this tract under fire-protection, without undue expense, it should be done.

The Karen area in the Thoonzai forest is situated east of the Thoonzai stream, and measures 20 square miles. It is occupied by seven tays or hamlets, with 57 toungya-cutters, who cut every year an area measuring about 171 acres.

### Koon Beeling Forest.

313. That portion of the Koon Beeling forest which has been demarcated as a reserve is a narrow strip, extending over a length of 14 miles from north to south, with an average width of $1\frac{1}{2}$ miles. Its area is 12,800 acres. The western boundary has been so laid as to exclude the paddy-fields of Nyoungbenzin and Shawdong, and a large area of forest east of Shawdong containing teak and bamboos. We passed through the southern part of the reserve on the 16th January on our way to Shawdong, and on the 17th we went from Nyoungbenzin up the Koon Beeling stream to the watershed between that and the Hmyah choung, a tributary of the Kadin Beeling. West of the ridge, which forms the line of watershed between the Koon Beeling on one side and the Hmyah choung and the feeders of the Thoonzai river on the other, is a large tract of undulating country, comprising the head-waters of the Koon Beeling, which formerly was regularly cut over by Karens, and is now nothing but a bamboo forest, with very few trees and almost no teak. More satisfactory is the forest on the head-waters of the Shawdong and Hmaia* choungs, which both join the Koon Beeling from the east. The present position of Tohdee tay is in the Koon Beeling reserve, on the head-waters of the Hmaia choung, and the toungyas of this year

* There is some doubt regarding the name of this small feeder of the Koon Beeling, whether *Hmyah* (arrow) or *Hmaia* (Growth).

are all in this locality; but as Tsokay Tohdee plants teak in all his toungyas, no separate Karen area has been demarcated for him.

In the Koon Beeling, between Tohdee tay and Shawdong, the following trees were measured:

| Girth. | | Height. |
|---|---|---|
| 46 inches | ... | ... 93 feet. |
| 68 do. | ... | ... 96 do. |

A very large number of trees between 18 and 54 inches in girth were observed in the Koon Beeling forests, and they were generally of good height. A large portion of the forest included within the reserve, south of the Hmaia choung, is evergreen, with a considerable portion of kanyin and some large tracts of cane brake.

**Teak Toungyas in the Thoonzai and Koon Beeling Forests.**

314. In 1875, Tohdee, the son of Tsokay Pala, commenced planting teak in his toungyas, which were then at the head-waters of the Kyaysay choung, a feeder of the Nat choung, in the Thoonzai reserve. He also planted teak in 1877, 1878, and 1879, the toungyas of 1879 being, as already mentioned, on the Koon Beeling side. Those of 1875 and 1879 were planted six feet by six feet. In 1875 alternate lines of Maizalee (*Cassia sumatrana*) were sown. The plantation of 1875 is well stocked with teak and maizalee, the height of the dominant trees being 20 feet. Maoo-lettan-shay (*Sarcocephalus cordatus*), which commonly springs up on toungyas in the southern part of the Tharawaddy district and grows more rapidly than teak, had, however, the upper hand here and had overtopped the teak, so that it had to be cut out.

In 1877 the plantations were made in bands 30 feet apart, each band consisting of three lines of teak planted at a distance of six feet by six feet. The dominant trees were about 15 feet high; but the lines were imperfectly stocked. The plantation of 1878 was also made in bands 30 feet apart; but the bands were broader, consisting each of eight lines six feet by six feet apart. The belts were fairly stocked, but the plants were of very unequal size, from three feet to ten feet high. In the plantation of 1879 the plants between the stubble of paddy were very small, only a few being above six inches. These plantations have all been fire-traced. The whole of them will now be included in one fire-traced block, estimated to cover an area of about 3,000 acres.

The fire-tracing consists in clearing a path six to ten feet wide, the trees being left standing. All inflammable material is heaped up on the outside, and burnt at the beginning of March, together with the forest outside the protected area. Tsokay Tohdee has entered into an agreement to protect the whole area, for which he receives an annual payment of Rs. 200.

**Kadin Beeling and Mokka Forest.**

315. The reserve which comprises the hills drained by the feeders of the Kadin Beeling and Mokka streams measures about 142 square miles. It includes two Karen areas: one on the Kadin Beeling, extending from the head-waters of the Toung choung to the junction of the Htonkyouk and Myouk choungs, measuring approximately 22 square miles. The northern Karen area extends from the Myouk Zanoon choung on the west to the mouth of the Tsabagyee, a feeder of the Mokka, the southern boundary being the Mokka choung and the watershed between the Taleindat and Mokka; the total area being about eight square miles.

Within the southern Karen area are located eight different Karen communities—

Upper Yaitho, Middle Yaitho, Lower Yaitho, Tetto-tay, Shwè Yah-tay, Pyoo Gway-tay, Tha Doon Oung-tay, Shwè Gya-tay.

Tetto-tay and the three villages of Yaitho are permanent settlements, with regular paddy fields, and the villagers are gradually extending wet cultivation over all available areas in the low-lying grounds on the banks of the streams.

The other four villages adhere to toungya cultivation; they have a few betel vines, and in addition they earn something by the collection of covering leaves for cheroots, and by giving assistance to Forest Department contractors.

In the northern Karen tract there is at present but one tay, that of Tsokay Oung-Bway. This settlement, which a year ago was one of the largest in the Tharawaddy Forest Division, has during the last rainy season, owing to sickness, dwindled down to seven or eight families. It contains also the grounds assigned to Tsokay Panhlay, who himself works as a Government teak timber contractor, and whose men have since the year 1873 regularly planted teak on their toungyas within the Mokka Beeling reserve.

**Character of the Forest.**

316. This reserve comprises some of the most valuable teak localities in the Tharawaddy district, but it also includes a large area of bamboo forest, in which the teak has been exterminated by continued toungya cutting. Beginning with the Hmyah choung, which joins the Kadin Beeling from the south, half way between Kwaymakaing and Yaitho, it may be said that the head of this side valley, which rises in the Kyetgalay Toung, is clothed with high moist forest, with kyathoung-wa and a good proportion of teak; that in the lower part of the valley the ridges are generally covered with excellent teak; but that contiguous to the teakless bamboo forest in the Koon Beeling are extensive areas of old toungya ponzohs, without teak and without value as forest.

West of the Hmyah choung watershed and south of the Kadin Beeling, there is a small corner of the reserve comprising the valleys of several small tributaries of the Kadin Beeling, and bounded on the west by the forests excluded for the villages of Kwaymakaing, Samboke, Kyaynee, Hnet-pyaw-dong and Nyoungbenzin.

**Excluded Forests.**

317. These excluded forests are exceedingly valuable, and contain large quantities of teak. On a march of two miles in the forest east of Samboke village, we counted teak—1st class 5, 2nd class 19, stumps 140; and a very large number of smaller-sized trees. This forest is extensively used by the villages named, and the consequence is that the other kinds have been used and cleared away, and that the growth of teak has thereby been improved.

**Areas assigned to Karens.**

318. The southern Karen area includes a large extent of old toungya ponzohs consisting of bamboo forest without teak, comprising the whole area south of the Kyouktaga stream.

North of this stream, and between it and the Myouk choung, the hills are covered with fine teak of all classes, and here the following valuation surveys were made on the 19th January:

The first survey extended over one and-a-half miles from the Kyouktaga to the source of the Pantin choung, and gave the following result:

| | | |
|---|---|---|
| I. Class | ... | ... 48 trees. |
| II. do. | ... | ... 41 do. |
| III. do. | ... | ... 128 do. |
| Stumps | ... | ... 103. |

Second survey, one and-a-half miles, along the ridge forming the eastern boundary of the Karen area, gave—

| | | |
|---|---|---|
| I. Class | ... | ... 44 trees. |
| II. do. | ... | ... 32 do. |
| III. do. | ... | ... 63 do. |
| Stumps | ... | 42. |

Third survey, continuation of above, length one and-a-half miles, ending at the junction of the Htonkyouk and Myouk choungs, gave—

| | | |
|---|---|---|
| I. Class | ... | ... 36 trees. |
| II. do. | ... | ... 22 do. |
| III. do. | ... | ... 46 do. |
| Stumps | ... | ... 47. |

East of the Karen area the ridges up to the Yoma generally contain a large amount of well-grown teak, while many of the valleys have poor and stiff soil, with toukkyan and other trees, but no teak.

Of the northern Karen area a large portion, particularly the valley of the Shoukpen choung, consists of old toungya ponzohs, which must once have been one of the best teak forests in Pegu, as proved by the very large number of stumps, the remains of trees felled long before the British rule commenced. A small number of second class teak trees and a considerable number of the smaller classes still remain.

**Forest west of Yaitho.**

319. The forest between the Mokka choung and the Kadin Beeling, west of Yaitho, generally known *par excellence* as the Mokka Beeling reserve, is one of the most valuable teak forests in Burma, and the greater part of it has been protected from fire since 1873. Near the Talein-that choung the ground is nearly level or slightly undulating, and it is stocked with a mixed forest without bamboos, the trees of which are exceedingly tall and well grown, with a large proportion of teak. Further south the ground is hilly, covered on the ridges and slopes with kyathoung-wa and tin-wa, which are here and there mixed with myin-wa, while thaik-wa is found in the valleys. In the north-east corner there is a considerable extent of eng forest, with engyin and theya. Except in the eng forest, there is teak throughout the reserve. The area of the teak-producing tracts west of Yaitho is about 15,000 acres, and they are estimated to contain upwards of 10,000 first class teak trees and 70,000 trees between 18 inches and six feet in girth. It is also certain that the second class trees, between four feet six inches and six feet, are more numerous than the first class trees. The smaller classes are so well represented that it will be possible, without injuring the prospects of the forest, to remove a large portion of the first class trees; and as a beginning it is intended to girdle 250 trees, commencing in the north-east corner.

The growth of the trees in the Mokka Beeling reserve is excellent, as shown by the following measurements:

| No. | Girth. | Total height, in feet. |
|---|---|---|
| 1 | ... 20 inches | ... 70 (age 25 years). |
| 2 | ... 84 do. | ... 111 (to 1st branch, 79 feet). |
| 3 | ... 83 do. | ... 110 ( do. 64 do.). |
| 4 | ... 29 do. | ... 90. |
| 5 | ... 30 do. | ... 94. |

**Works of Improvement.**

320. The works of improvement undertaken in the Mokka Beeling reserve have consisted in fire protection and planting. Since 1873 an area of 14,000 acres has been protected against fire without failure, and the area successfully protected in the hot season of 1880 has been 24,000 acres.

Fire protection has hitherto been secured by clearing a fire-trace, which is 60 feet wide on the west and south sides, and 30 feet wide on the east; while on the north all that has hitherto been necessary has been to keep clear a narrow path of grass and leaves, the jungle outside this path being burnt every year. All trees on the fire trace, except teak, have been girdled or felled, and grass and brushwood are cut every year, heaped up on the outer edge of the trace, and burnt.

The fire trace is kept clear by means of an arrangement concluded on the north side with Tsokay Panhlay, on the east with Tsokay Thamenoo of Yaitho,

and on the west and south with the Burmans of Kyoung-youa and Samboke. Each party receives an annual remuneration, provided the reserve is not burnt; and the total outlay during last season was only Rs. 1,287.

The effect of fire protection is seen in a large increase of young teak, some of which are natural seedlings, but chiefly shoots from underground stocks. It is also seen in a more luxuriant growth of bamboos, which in this reserve is by no means favourable to the growth of teak. Owing to the dense growth of bamboos and other trees, the natural reproduction of teak in this forest has not benefited as much as in other reserves, where the ground is less moist and the climate drier.

The plantations made in this reserve have been as follows:

**Kwaymakaing Plantation.**

321. An area of 144 acres has been planted on the hills overhanging the Kadin Beeling river, to the north of Kwaymakaing village. This plantation was made in 1867 and 1869. The teak was planted at a distance of six feet by six feet, and a small area in 1867 in lines ten feet apart and four feet within the lines. On level ground near the Beeling river, where the teak had no bamboos to contend with, the success is every thing that could be desired, and the following are the measurements, taken at the time of our visit, of average dominant trees:

| Year of plantation. | Height. | Girth. |
|---|---|---|
| 1869 ... | ... 60 feet | ... 21 inches. |

Two years ago a number of trees died in this part of the plantation without any apparent cause, except that black spots, probably caused by a fungus, were discovered in the wood. All the dead and dying trees were then removed, and since then the disease has ceased.

On the hills the teak has had to contend with the bamboo, and although in many places the bamboo has been thinned out to give room to the teak, yet many teak trees have been killed out; and although this part of the plantation will eventually be a sufficiently well-stocked teak forest, still the success is not complete. In this part of the plantation the following measurements of dominant trees were taken:

| Year of planting. | Height. | Girth |
|---|---|---|
| 1869 | ... 40 feet | ... 16 inches. |
| 1867 | ... 60 do. | ... 22 do., on gentle slope. |
| 1867 | . 40 do. | ... 15 do., on top of ridge. |
| 1867 | ... 50 do. | ... 18½ do., in tin-wa and kyathoung-wa. |

In 1876 it was found that the bamboo had overtopped the teak in the plantation of 1867, and it was therefore thinned out on a large scale.

**Toungya Teak Plantations.**

322. Toungya teak plantations were made by Tsokay Moung Panhlay on the feeders of the Talein-that, a tributary of the Mokka choung. They were commenced in 1869, and have been continued annually, with few interruptions, since 1873. They now measure 875 acres. These plantations form numerous belts of irregular shape and unequal size; but they will be extremely valuable for increasing the proportion of teak in these forests, and they are all included in the fire-protected area. The first plantation made by the Tsokay in 1869 is now a young teak forest, in which the trees are on an average 57 feet high, with a girth of 20 inches.

The older plantations were all made at six feet apart, but in 1876 experiments in planting in lines were commenced. In 1876 and 1877 the plan followed was to plant the teak in belts, consisting of three lines at six feet distance, with 30 feet between the belts. In 1878 the belts were made wider, consisting of eight rows six feet apart, also with 30 feet between the belts of teak. Experience here, as elsewhere, has shown that a distance of 30 feet between the belts is too great, and that the best plan is to plant in lines 10 feet apart, the plants being close together within the lines, or at

regular distances six feet apart. This plan seems to secure to the teak, better than any other plan, predominance over the bamboos.

The following measurements were taken of dominant trees:

| Year of planting. | | Height. | Girth. |
|---|---|---|---|
| 1873 | ... Block I. | ... 40 feet | ... 16 inches. |
| 1873 | ... do. II. | ... 46 do. | ... 17 do. |
| 1873 | ... do. III. | ... 55 do. | ... 17 do. |
| 1874 | ... ... | ... 33 do. | ... 13 do. |

In these toungyas, as in those of the Koon Beeling, *Sarcocephalus cordatus* (Maoo-lettan-shay) is common and troublesome. Its growth is much more rapid than that of teak, and it overtops the teak always. A tree of this species in the plantation of 1874 measured 20 inches in girth and was 44 feet high.

### Other Cultural Operations.

323. A number of belts in bamboo forest have been cleared (the bamboo clumps being carefully burnt, so as to kill them outright) and planted with teak six feet apart; this was done in 1877. The belts are 100 feet wide, and vary in length. The teak stands thick, and the growth is excellent, the average height of the plants being between 15 and 20 feet. The teak here has benefited by the absence of the bamboos and by the standing forest on either side of the belts, which preserves moisture in the ground.

In the south-west corner of the reserve large areas were treated in various ways by dibbling in seed in suitable places. The first experiment, made in 1876, was in tree forest without bamboo; most of the trees were girdled and teak seed dibbled in. The result is very satisfactory, the trees being 12 to 15 feet high. The next experiment was to cut down bamboo (mostly tin-wa) without burning, previous to sowing. Here the success has been unequal. In some cases the trees are 10 feet high, and in others the seedlings have been choked by the bamboo. The third experiment was to sow teak seed where bamboo had flowered. Here the bamboo has in most cases got the better of the teak, but some of the plants may survive, especially those sown early enough in the first year.

The comparative expense of these different cultural operations stands as follows:

The Kwaymakaing plantation has cost up to date, including maintenance charges, Rs. 110 per acre.

The toungya teak plantations are paid for by the number of young plants alive during the first dry season, at the rate of one rupee for 100 plants. If sown six feet apart, the number of plants which survive and are paid for averages about 600 per acre, entailing an outlay of Rs. 6 per acre. In addition to this, capitation tax and toungya tax are paid by Government, and the plantations are cleared during the first two years at a cost of Rs. 2-8 per acre a year, so that the total outlay amounts to about Rs. 13 per acre. The cost of the existing toungya plantations in the Mokka Beeling reserve, however, has been less; only about Rs. 10 per acre on an area of 875 acres.

The planting in cleared belts has been expensive, having cost Rs. 60 per acre. The peculiar feature in this operation is that the belts are narrow, and that the bamboos are burnt thoroughly, so as to ensure their being killed outright. If the cost can be reduced, which will doubtless be feasible, the plan should have a further trial on a larger scale.

The dibbling in of teak seed among dead bamboos or under girdled trees has cost here Rs. 4-3 per acre; but the work was new, and can be accomplished at less cost in future. There seems no doubt that, unless the cost of planting in narrow belts can be much reduced, toungya teak plantations are in this reserve the most effective and economical method of increasing the proportion of teak in the forest. The dibbling in of teak seed under girdled trees, where there are no bamboos, may also be continued; but in bamboo forest the risk of the teak being overtopped by the bamboo is too great here.

**Effect of Bamboo upon Teak planted in th- - - - - -**

324. In a forest where teak is sown after the bamboo has flowered and died, the teak has a start before the bamboo grows up. During the first few years after flowering, the thicket of the slender bamboo seedlings is shorter than the young teak, and it is only when the full-sized shoots make their appearance that the teak is apt to be choked. Thus in forests where the bamboo has flowered, it all depends upon this—whether the teak has had time to grow high and strong enough to maintain its own against the bamboo when the full-sized shoots appear.

In toungyas and other plantations, where the bamboo is cut, it chiefly depends upon the more or less complete burning. When the bamboo clumps have been killed outright by the fire, the teak is safe, and this explains the good success of the 100-foot belts. But in toungyas and ordinary plantations the burning is not generally sufficient to kill out the bamboo. Much also depends upon the season. If the rain falls too early, the toungya burns imperfectly, and there is greater risk of the teak being choked by the bamboo than in a good season when the burning has been thorough. The bamboo clumps which have not been destroyed by fire produce shoots mostly near or outside the circumference. During the first two or three seasons these shoots are only a few feet high, but the shoots of the fourth year attain their full size and then the risk commences. Tin-wa, owing to its dense foliage and the larger number of clumps which stand closer than in the case of most other bamboos, is most apt to choke the teak. Kyathoung-wa is also injurious, and most of all tabendein-wa, which however is not found in the Tharawaddy district. Myin-wa (*Dendrocalamus strictus*) is less injurious, owing chiefly to its lighter and more open foliage.

The chief difficulty in the Mokka Beeling forest is the luxuriant growth of bamboos and other trees, and it would be a great advantage if more bamboos and other woods could be exported from the forest. The people of the neighbouring villages are now permitted to take away bamboo and other woods for their own requirements, and this should in every way be encouraged.

**Myodwin Plantation.***

325. This small and interesting plantation, in the vicinity of the village of Myodwin, was formed during the years 1862, 1863, and 1864, chiefly by the Karennee coolies who, during the dry weather, were employed in blasting obstructions in streams required for floating timber. The approximate area is 10·75 acres, and it is divided into two blocks; but as no complete record has been kept, it is not possible now to trace exactly the limits of the plantations of each year.

The plantation of 1862 was formed by sowing seed in lines six feet apart; that of 1863 by transplants from nurseries, three feet apart with 10 feet between the lines; and that of 1864 by seed sown in lines 10 feet apart and three feet within the lines. The plantation was thinned in 1867 and again by Mr. Oliver in 1876. Previous to 1867 suppressed and unhealthy seedlings had been removed, and a judicious thinning would now be beneficial. The cover throughout the plantation is complete; there is no undergrowth; the trees are healthy in appearance; the stems straight, free from low side branches; and the bark is generally sound. The portion planted in 1863 has been most successful, the growth in height and girth being equal to or exceeding that of 1862.

The following figures show the average height and girth of dominant trees:

| Year of planting. | Height. | Girth at 5 feet. | |
|---|---|---|---|
| 1862 ... | 68 feet | 27 inches. | |
| 1863 | 72 do. | 30·5 do. | (better portion). |
| 1863 ... | 68 do. ... | 27 do. | |
| 1864 | 62 do. .. | 25 do. | |

* For this note I am indebted to Mr. E. P. Popert, the Officer in charge of the Tharawaddy Division.

The counting of a small plot 100 feet by 125 feet in the 1863 plantation gave 130 trees, with an average girth of 20 inches, or 453 trees per acre.

Endeavours have been made to protect the plantation from fire since the date of its formation; previous to 1868 with varying success. Since then, however, with the exception of 1878, fire has been steadily excluded. The total cost of the Myodwin plantation to the end of the official year 1879-80 amounts to Rs. 855, of which Rs. 431 are debitable to formation, weeding, thinnings, &c., and the balance Rs. 424 to fire protection.

No separate establishment is maintained at present to look after the plantation, it being under the charge of the Boben Forester.

**Kangyee Forest.**

326. The Kangyee forest occupies the high ground in the plain between the Minboo and Boben streams, and the area stocked with teak extends far beyond the limits of the present reserve, which measures only 3,800 acres. In the greater part of the reserve the soil is a stiff loam, with deep cracks after the rains, and the teak is very unequally distributed. In the northern part there are large areas of old toungya clearings stocked chiefly with young forest of toukkyan, bingah, zimbyoon, and a small proportion of teak. In the centre teak predominates, and here natural re-production has been excellent. The first class teak trees were counted in 1867-68: 2,000 trees were counted, containing marketable timber.

This forest has been protected from fire since 1877. Protection was originally secured by a cleared belt 300 feet wide; but as it was found too expensive, and not necessary to keep this whole belt clear, a portion only of the belt, 12 feet wide, is cleared completely, and the rest, as well as the forest outside, is burnt every year. The main road which passes through the entire length of the forest from Kangyee to Boben Sakangyee, and which is largely used for carting bamboos from the Boben forest, has been straightened, and a belt on either side of it is kept clear and burnt annually.

**Cultural Operations.**

327. The following cultural operations have been undertaken in this forest:

*First.*—A number of teak toungya plantations have been made by the inhabitants of Kangyee and Shwaybala village in the north-western part. These plantations were made in 1878 and 1879. In 1878 bands of eight lines of teak trees were planted, with 30 feet intervening between the bands, while in 1879 the teak was planted six feet by six feet throughout. I noticed that a number of young vigorous teak trees had been cut in some of these toungyas, which practice must by all means be discouraged in future.

*Second.*—Teak seed was dibbled in throughout the forest in 1877, 1878, and 1879, with good success, light being given by girdling trees of other kinds. The oldest plants were four to five feet high at the time of our visit.

There is a large proportion of teak trees of the smaller classes on the ground, and by steadily continuing these cultural operations in that portion of the forest where teak is wanting, it will be possible gradually to stock nearly the whole area with teak. As soon as these cultural operations have sufficiently advanced, it will be well to cut out the whole of the first class trees as far as they are marketable, and they may then be girdled all at one time.

**Thitcho Forest.**

328. On the north bank of the Minboo choung is the Thitcho reserve, which we examined on the 2nd February. The soil and forest are similar to that in the Kangyee forest, except that cutch is more common. Teak was planted here in a toungya in 1869, and about an acre remains; but fires have gone through it every year, and the growth of the trees is not very good.

### Boben Forest.

329. The fire-protected area in the Boben forest is 614 acres, and it includes the corner between the Boben and Thayet streams. This area has been protected since 1869*, and in the corner between the two streams a teak plantation was made in 1868 and 1870. The soil is a light sandy loam and very suitable for the growth of teak; but a large portion of the teak has been killed out by the bamboo, chiefly tin-wa. A part of this plantation was made in lines six feet apart, the plants between the lines being at a distance of three feet, but even this arrangement has not prevented the teak being choked by the bamboo; while, where there was no bamboo, the teak trees stood too close and impeded each other's growth. The distance of six by three feet is too small for teak, and we have come to the conclusion that, wherever there is fear of bamboos overtopping the teak, six feet by six feet is probably the best distance, and, under certain circumstances, lines ten feet apart, and the plants at a distance of three to four feet within the lines. On a small area cutch was planted with teak, but the cutch has grown much faster than the teak and interferes with its proper development. Thus in part of the area planted in 1868, the average girth of the dominant teak trees was 21 inches, while cutch had attained a girth of 31 inches. In 1871 fears were entertained lest the cutch would overtop the teak and the cutch trees were therefore thinned out. Although a great many teak trees have been suppressed by the bamboos, there is still sufficient on the ground to form a teak forest, and the following measurements will show that the rate of growth is satisfactory:

| Year of planting. | Height. | Girth. |
|---|---|---|
| 1868 | 61 feet | 22 inches. |
| 1868 | 70 do. | 24 do. |
| 1868 | 54 do. | 26 do. |
| 1870 | 49 do. | 18 do. |

Since 1875 a number of teak toungya plantations have been made by the inhabitants of Sakangyee village. In the plantations of 1876 the trees had attained a height of 20 feet, and the bamboos had not yet overtaken them. The plantations of 1877 were in belts of three lines, like those of 1874; the belts were well stocked, and the average height was six feet. We also saw some of the plantations made in 1878 and 1879.

### Padinben and Shaboung Forests.

330. On the 4th February we went through part of the Padinben, Shaboung, and Thapan forests and counted the following teak trees:

Between the boundary of the Padinben reserve and the head-waters of the Padinben choung, on a length of three miles—

| | |
|---|---|
| First class | 151 trees. |
| Second do. | 38 do. |
| Third do. | 133 do. |
| Girdled trees | 15 |
| Stumps | 167 |

From the Padinben choung, chiefly along the ridge which separates the head-waters of the Shaboung from those of the Padinben and Thapan choungs, over a length of three miles—

| | |
|---|---|
| First class | 102 trees. |
| Second do. | 40 do. |
| Third do. | 120 do. |
| Girdled trees | 6 |
| Stumps | 90 |

In the Kokee forest, from the point where the Singalay and Gyoben-aing road crosses the Shaboung, to the boundary of the reserve, over a length of four miles—

| | |
|---|---|
| First class | 133 trees. |
| Second do. | 30 do. |
| Third do. | 114 do. |
| Girdled trees | 20 |
| Stumps | 30 |

* The area actually protected in the hot season of 1880 was only 597 acres, 17 acres having been burnt.

Along the boundary of the reserve to Singalay, over two miles—

| | | | | |
|---|---|---|---|---|
| First class | ... | ... | ... | 30 trees. |
| Second do. | ... | ... | ... | 14 do. |
| Third do. | ... | ... | ... | 39 do. |
| Girdled trees | ... | ... | ... | 24 |

The numerous girdled trees counted on these surveys were mostly useless; either hollow or injured by fires, which are most destructive in these forests. Of bamboos, myin-wa prevails on high and thaik-wa on low ground; only in a few places in the Shaboung forest is kyathoung-wa to be found, on ridges and slopes with good soil. The chief associates of teak, are touk-kyan, sha, and gwayben, which is very common.

The soil is mostly a stiff clay, with deep cracks in the dry season. These forests are extremely dry; they are leafless from February until April, and the soil, exposed to the full force of the rain, and unprotected by grass and leaves, which the fires sweep away annually, gets hard and scorched. Hence they have made very little progress, since they have been under conservancy. The growth of the first class trees is very slow, and young growth is very poor; the second and third class trees are almost entirely confined to certain plots on which the myin-wa had flowered. It may be said that these forests are almost at a stand-still at present, and until fires are kept out they will make no progress.

In the adjoining Bwet choung forest, fires have been kept out for the last three hot seasons; and as soon as officers and money are available, fire protection should be extended to the Padinbon and Shaboung forests. The result will doubtless be a profusion of young growth of teak, and when the young trees have made sufficient progress, all marketable first class trees should be taken out. The proportion of hollow trees is very large; and even if all marketable trees are girdled, there will be a sufficient number of seed-bearing trees left, which are not fit for the market, to ensure continued re-production.

Until 1859 the Kokee forest, in the Shaboung reserve, was one of the finest forests in Pegu. But in that year a large number of Burman families came over from Poungday and settled in the heart of the forest, cutting and burning toungyas in the midst of the best teak localities. The fires which spread from these toungyas made a large proportion of the first class trees useless for yielding timber, and they killed or injured for life the trees of the smaller classes. The squatters have left, but the effect of the destruction remains. The toungyas cut at that time on the banks of the Shaboung stream have now grown up into young forests, which consist of a variety of trees, but contain very little teak. There is a large proportion of cutch and bingah, and the cutch seems to have grown more quickly than any of the other trees.

### Cutch Manufacture.

331. As late as 1868, the low hills and rising ground which separate the stretches of paddy fields in the Toungnyo valley were full of large-sized cutch trees, all of which have now been cut down for catechu manufacture. The cutch boilers have gradually gone up the valley, and they are now engaged in cutch boiling above Thamadee village. We found one settlement of people who had come here from the vicinity of Meaday and Kama for the purpose of cutch manufacture. They had taken out permits for 24 cauldrons. Another settlement of cutch boilers was lower down the river, and similar settlements are scattered throughout the Toungnyo forest. Each cauldron pays Rs. 10 for the season, and it has already been mentioned, in paragraph 28, that the consumption of trees may be estimated at 80 trees per cauldron during the season of four months. The revenue realized in 1879-80 from cutch alone in the Thayet, Prome, and Tharawaddy districts is stated to have been Rs. 43,124. Only a portion of this was at the rate of Rs. 10 per cauldron; in Prome and Thayet the rate was lower. Hence the

number of trees cut in one year for cutch boiling in these three districts may be estimated at not less than 500,000. At that rate, it is easy to understand what the end of this industry must be.

Lower down the Toungnyo valley all large cutch trees have already been cut, and in a few years more the only large cutch trees left will be in the reserved forests.

The following is the result of enquiries made by Mr. B. Ribbentrop, the Conservator of the Pegu Forests, regarding cutch boiling in the Thayetmyo district.

| | Rs. |
|---|---|
| *Expenditure.*—Cost of plant and permit for the season ... | 19 |
| Wages of two men for three months ... | 90 |
| Hire of one pair of bullocks for three months | 45 |
| TOTAL ... ... | 154 |
| *Outturn.*—During three months 900 viss at Rs. 30 for 100 viss ... ... ... | 270 |

This gives a profit of Rs. 116 per cauldron for three months. It is clear that the rate per cauldron might be raised to Rs. 20 without hardship to the manufacturers.

**Nyanlay Reserve.**

332. The high ridge which forms the watershed between the Nyanlay and the Thayet choungs runs out into numerous branches, which separate the feeders of the Thayet and Nyanlay choungs. These hills occupy the northern part of the Nyanlay reserve and are well stocked with teak in forest of kyathoung-wa and myin-wa. Near the Nyanlay choung there is a large extent of second growth sprung up on deserted toungyas, and in which teak is scarce. Cutch is a common tree in this forest, attaining a large size, with tall straight stems. We measured one as a sample, 48 feet to the first branch, and nine feet three inches in girth. The distribution of teak in this forest may be noticed from the surveys made in 1868 and which gave on 100 acres—

| | |
|---|---|
| First class ... ... ... ... ... | 209 |
| Second do. ... ... ... ... ... | 166 |
| Third do. ... ... ... ... ... | 368 |

This survey was made in the northern part, which is well stocked with teak.

On the 5th February we counted in the southern part of the forest, below the ridge, between the Nyanlay and Thayet choungs, over a length of nine miles and on a width of about 100 feet, the following trees:

| | Trees. | On 100 acres. Trees. |
|---|---|---|
| First class ... ... ... ... | 34 | 31 |
| Second do. ... ... ... ... | 33 | 30 |
| Third do. ... ... ... ... | 133 | 122 |

The forest on the south side is poor and needs planting up with teak.

The Nyanlay reserve has been protected from fire since 1877. This protection was first effected by clearing a belt 200 feet wide, but this year, to save expense, only a narrow strip, 12 to 15 feet wide, of the old cleared belt has been cleared again, the forest outside being burnt. The protected area is bounded on the south by the Nyanlay choung and on the north by the Thayet choung, but the cleared line runs at some distance inland of these two streams.

In this forest three toungya teak plantations were made in 1879 by the people of Nyanlay village, and teak seed has been dibbled in extensively on plots where the myin-wa had flowered. We inspected the place where the operations of 1878 and 1879 were made, and their condition was very satisfactory. The young teak plants are plentiful, and have attained a good size.

Myin-wa in the drier climate and on the dry soil of this forest does not grow as rapidly as tin-wa in the moister climate and on the richer soil of the Mokka Beeling reserve. It may safely be assumed that the dibbling in of teak in this forest will largely increase the proportion of that tree, and it should be continued.

**Prome Plantation.**

333. The teak plantation on the hills south of Prome was established in 1857 as an experiment, in order to have an opportunity to determine, at a place easily accessible at all seasons of the year, the best system of planting teak in Burma. It was known at the time that the soil was poor and rocky, but no other suitable locality was available. The system followed was to plant lines ten feet apart and four feet between the plants within the lines. In this locality this plan has answered well, and the western part of the plantation, which was the one taken in hand and completed first, is stocked with a healthy forest of trees, of which those which are dominant have attained the following sizes. On the level ground in better soil, the average height was 77 feet, and the average girth 36 inches; the greatest girth attained being 45 inches, and the greatest height 89 feet. On the hill and in poor rocky soil, the average height was 61 feet, and the average girth 26 inches. In 1877 some of the trees commenced to flower and to seed, but the seeding has not increased. The plantation had not been thinned extensively until 1876. Since that year, however, it has been thinned every year. The thinnings sell; they do not, however, more than pay their expenses. But as regards the growth of the teak and the condition of the plantation generally, the effect of these thinnings has been most marked and beneficial. The light given over head by these thinnings has greatly promoted the growth of shrubs and small trees under the shelter of the teak. Much of this undergrowth is evergreen, and its effect is beneficial, inasmuch as it will tend to preserve moisture in the ground. The most noteworthy species are the Bael tree (*Aegle Marmelos*), the clearing nut (*Strychnos potatorum*), and the Elm (*Ulmus integrifolia*). A few tamarind trees were left standing at the time the plantation was formed, with the hope that there would be an abundant growth of young tamarind. This has not however been the case. A few plants of mahogany have been planted under the teak trees, in order to determine whether that tree will thrive under the shade of the teak, but it is too early as yet to form any conclusion.

The back part of the plantation was not planted up in the commencement, but was operated upon at a later period. This part of the area has never received sufficient care, and it contains very little teak, but no further planting is here proposed. The value at present of the Prome plantation consists in this, that it forms a convenient field for experiments in thinning, regarding which we have still a great deal to learn. It will also furnish opportunities for experiments regarding the cultivation of evergreen trees and shrubs under teak, and lastly it will teach us more regarding the mode and rate of growth of teak.

Special attention should be paid in this and other plantations to the development of teak trees which have commenced to flower and seed. In such trees the terminal shoot generally bears flower panicles, and the question is whether in such cases new terminal and leaf-bearing shoots are formed, or whether the growth in height of the trees is impeded by premature seeding.

# CHAPTER XI.

## TOUNGOO.

### Pyoon Choung Plantation.

334. The Pyoon choung reserve, which has been protected against fire since 1877, contains 3,400 acres, of which 696 acres have been planted with teak.

### Boundaries.—Fire protection.

Up to Hlaigoo-zaik the Pyoon choung forms the western boundary of the reserve. Beyond this point the reserve occupies both sides of the stream, and the north boundary crosses the Pyoon choung at a point distant about four miles from the junction of the Pyoon choung with the Thouk-ye-gat river.

The north and south boundaries are roads; and wherever the stream does not form the boundary, it is marked by a line, which was originally cleared to a width of about 30 feet; and of this a portion, about 12 feet, is cleared every year, and the forest outside of the cleared line is burnt. There are also a number of internal fire lines, dividing the reserve into blocks.

### Area planted.

335. The area planted is chiefly on the east side of, and near the Pyoon choung, and in that part of the reserve which is on the west side of the river. The oldest plantations date from 1866, 1867, and 1868, and these have been successfully protected ever since they were first established. A large portion of the plantation of 1869, however, on the left bank of the Pyoon choung, and of the plantation of 1870, was burnt in 1874.

Outside the southern reserve boundary, south of the road, there are some plots, planted in 1869, which at the time of demarcation were excluded from the reserve, but which are reported to be well stocked, and should be included. A larger area will have to be demarcated in this district, and when this work is taken in hand, the limits of the Pyoon choung reserve should be so extended as to include a river frontage on the Thouk-ye-gat.

### Soil and rock.

336. The best stocked blocks are those near the Pyoon choung on deep diluvial soil, particularly that portion which is near and above Hlaigoo. On the high ground in the upper part the rock is gneiss, and the soil a rich loam, with much vegetable mould, and with that rough surface which in Burma is peculiar to soil overlying that kind of rock. Lower down the stream, the soil on rising ground is laterite, and here the growth of teak has been much less rapid.

The plantations are thus situated on soil of three different descriptions, viz., diluvial soil, near the stream; laterite, on rising ground lower down; and soil overlying gneiss, higher up the stream.

### Measurements.

337. The following measurements were taken as average samples of dominant trees in each plot examined:

*Plantations of* 1866 *and* 1867.—*Area*, 44 *acres.*

In the plantations made in these years, teak was grown with til seed (*Sesamum*), which ripened in September of the first year, and after which a crop of cotton was generally raised. The total area planted was 94 acres, of which a portion was submerged by the inundation of 1867, which destroyed 50 acres. The area remaining stocked may be estimated at 44 acres.

According to the journal appended to the working plan of 1868, teak was planted in lines eight feet apart in 1866, and six feet apart in 1867. In 1868 the average height of the plants of 1866 was seven feet, and of 1867 10½ feet. The average results of the measurements taken on our present visit (February 1880) are as follows:

Near the rest-house, on diluvial soil—average girth, 26 inches; height, 59 feet.

On similar ground, a little higher up the stream—girth, 23 inches; height, 62 feet.

On laterite, on rising ground, apparently planted 6 feet by 4 feet—girth, 20 inches; height, 56 feet.

Near this plot there is some low ground where thaik-wa has come up among the teak. On the average, the bamboo is taller than, or as tall as, the teak trees, and these are thin and much drawn up. But the bamboo will not grow taller, while the teak will eventually form a crown above the bamboos. This part of the plantation, although at present looking wretched, will probably in the end be very satisfactory.

*Plantation of* 1868.—*Area,* 120 *acres.*

This plantation was planted on diluvial soil, apparently 6 feet by 4 feet, and gave—girth, 20 inches; height, 59 feet.

Another plot on similar soil, apparently planted 8 feet by 3 feet, gave—girth, 20 inches; height, 60 feet. This plot is completely stocked, but the dominant trees are not as well marked as in other blocks, and require thinning out badly.

*Plantation of* 1869.—*Area,* 184 *acres.*

Close to the river's bank, on excellent diluvial soil—girth, 26 inches; height, 72 feet. This plot, which is just above Hlaigoo-zaik, surpasses in growth any plantation in Pegu of the same age. The nearest approach to it is Kwaymakaing of 1869, with an average girth of 21 inches and an average height of 60 feet. Some parts of the Choungwa Plantation, Boben district, of 1868, are nearly as good, with a girth of 24 inches and a height of 70 feet.

*Plantation of* 1870.—*Area,* 296 *acres.*

On low hills. The teak is mixed with bamboo on the slopes, and there are stretches of tall grass in the hollows. The measurements gave—girth, 19 inches; height, 50 feet.

A large portion of the area planted in 1870 in the centre of the plantation is imperfectly stocked, and has suffered severely from fire. It is completely covered with tall kaing grass, with, however, a few plots in which teak had overtopped the grass and had attained an average height of 15 to 24 feet and a girth of 12 inches. It is remarkable that in this plot the teak trees do not at all look healthy. The bark is soft, with large black blotches of fungus and with lichens of different kinds growing on it. This is generally the character of teak grown in places where the soil and climate are too moist, but excessive moisture can hardly be the cause in the present case.

There are also small plantations of 1874 (50 acres), and one acre of 1877 near the rest-house.

**Conclusion.**

338. Upon the whole, the teak plantations in the Pyoon choung reserve are most promising. The older ones would profit greatly if the large number of the weaker trees could be thinned out. But upon the whole it must be said that the plan followed, of having the plants close together in the lines which are generally eight feet apart, has greatly facilitated the killing out of grass and weeds, and has accelerated the natural selection, which has resulted in the survival of the strongest plants.

The belts planted with teak are not continuous, but are interrupted by stretches of natural forest. In these wa-pyoo and kyathoung-wa are the chief bamboos. The latter had flowered about ten years ago, and in its place a young forest of pymma, letpan, and other trees, with a good proportion of teak, had sprung up.

We went through a considerable portion of the natural forest intervening between the planted blocks in the northern part of the plantation, and found a large proportion of teak of the smaller classes on the ground. The large trees are not very regularly shaped, as has already been noted in the journal for 1868. But there is no ground for anticipating that the trees in the plantation will not form tall and well-shaped stems.

The lower part of the plantation was planted up with pine-apples in 1875. The plants thrive, but have not borne fruit.

In the Pyoon choung we found a large number of logs, said to be of Thitto (*Sandoricum indicum*), which were cut in the forest above the reserve. The wood is sent down to Rangoon, and is said to be used for planking, but it seems a matter for regret that a valuable fruit tree like this should thus be cut on a large scale.

Along the Pyoon choung, in the north-east portion of the reserve, there is some very good soil not planted with teak, and here I would recommend that, as an experiment, tea, coffee, and *Cinchona succirubra* be cultivated. The stream is perennial, and in its immediate vicinity the forest is moist, even during the dry season. The success of these experiments is doubtful, but the Pyoon choung is a suitable locality; and if a bridle-path were made to facilitate inspection, supervision would not be difficult.

As soon as money can be spared, the internal fire lines should be cleared, and a survey, with prismatic compass and chain, should be made of the outer boundary line and of all internal sub-division lines. The reserve with the planted area is extremely valuable, and it would be useful to have a map of it on a scale of at least two inches to the mile.

It will probably be found advisable not altogether to abandon the establishment of regular plantations in Pegu. If so, a large extension may be made in the Pyoon choung reserve and the adjoining portions of the Thouk-ye-gat forest. The teak grows rapidly, the supply of labour is less difficult than elsewhere, and the locality is conveniently situated for supervision.

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NOTES ON THE MARCH FROM TOUNGOO VIA PLU-MU-DOE TO LOMATEE.

339. I made the journey from Plü-mü-doe to Lomatee in February 1859; and as I had to go across from Toungoo to Papoon this year to meet Major Seaton, the Conservator of Forests of the Tenasserim Circle, I selected this route as being the shortest and as giving me an opportunity of seeing the small plantation of *Cinchona succirubra* made at Plü-mü-doe in 1868, and of discussing on the spot, with the Karen inhabitants of these hills, the cultivation by them in their gardens of the red bark and perhaps also of *Cinchona Calisaya*.

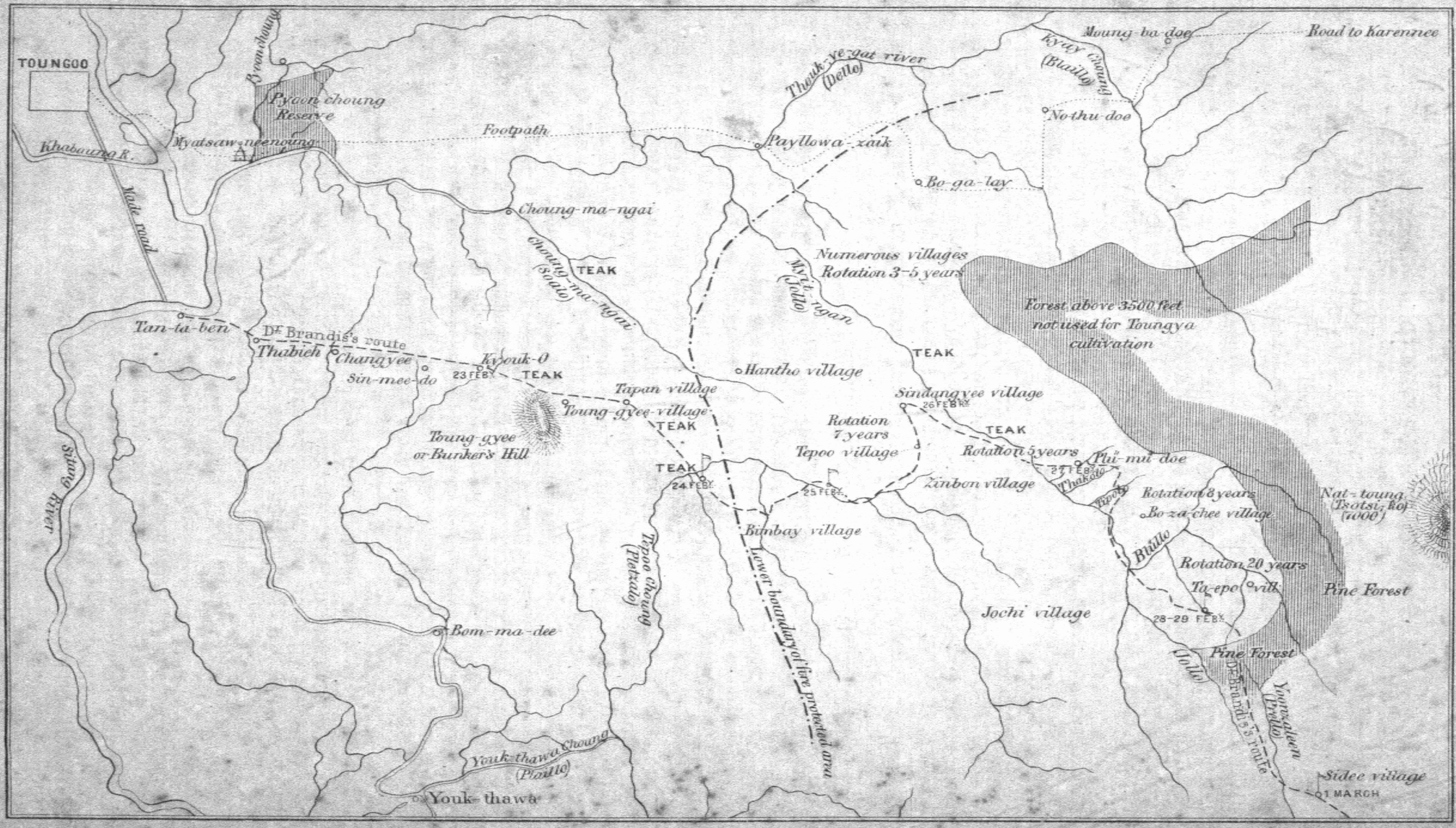
The present notes of my march are recorded in detail, because a portion of the route followed by me is not generally known, and because it leads through a country of great interest, which I am inclined to believe is capable of great development in future. It will be most convenient to record my observations in the shape of a diary.

Toungoo to Kyouk-O.

340. *Monday, 23rd February* 1880.—Crossed the river at Tantaben, and followed the cart-road to Thabieh and Changyee, two large Burmese villages, with extensive paddy-fields, east-south-east of Tantaben. The road, which is practicable for carts to Kyouk-O, leads through mixed forest, and then passes a Pagoda (Goon-nway-paya), with a kyoung situated in the midst

# SKETCH MAP of the HILLS SOUTH of the THOUK-YE-GAT RIVER, TOUNGOO DISTRICT.

*Scale 1 Inch = 4 Miles.*




Lithographed at the Surveyor General's Office, Calcutta, January 1881.

of the forest, and soon after enters the eng forest which forms an almost continuous belt on the high ground between the hills and the deep alluvial soil of the valley. Surrounded by eng forests there are, however, large stretches of low ground well adapted for paddy, which are occupied by a number of Karen villages, the inhabitants of which are mostly Christians. The first of these villages visited by me was Sin-mee-do, a little off the road to the south. Most of the people here had come from the hills east of the Kyay choung and beyond the water-shed which divides the feeders of the Salween and Sitang rivers. The place from which they had come is called Booko, and is situated north of the road from Toungoo to Karennee, between the villages of Oo-bo and Ko-tee-doe. They had come down about six years ago, on account of the famine in those hills, caused chiefly by an enormous multiplication of rats. They had brought money with them, which enabled them to buy buffaloes. These people had in their former homes lived at an elevation of about 4,000 feet, in a pleasant and cool climate, cutting their toungyas in the pine forests which clothe the hills east of the Salween water-shed, and they have now of their own free will moved down into the hot tropical valley of the Sitang. At first they suffered a great deal from fever, but that has ceased, and they seem now to enjoy good health. They have abandoned the custom of building large tays, where a number of families live under one roof, and have instead adopted the plan of separate houses with thatched roofs, which are more suited to the climate of the plains. They have also abandoned the practice of cutting and burning the forest for their fields, and have learnt ploughing and the management of permanent paddy-fields; in fact, they have altogether changed their mode of life, but the change seems to have been perfectly successful.

Other Karen villages in the vicinity are—Kyouk-O, where we encamped, and which is built in the eng forest; Yay-shan, and Shazee-bo. The population of these villages chiefly consists of people who have come down from the hills. The population in the hills, especially in the valley of the Myit-ngan, a southern feeder of the Thouk-ye-gat, is in many places larger than can be supported, under the existing system of toungya cultivation, by the land belonging to each village. And though there are a number of well-to-do people, who own large betel-palm gardens and extensive areas of toungya grounds, still there are also poor people who find it difficult to live in the hills, and who gladly join the Karen villages in the plains.

### Kyouk-O to Te-poo Choung.

341. *Tuesday, 24th February.*—The road leads partly through eng forest, partly over undulating ground and low hills with bamboo and teak, and for some distance through the paddy-fields of Toung-gyee, a Christian Karen village, situated at the foot of a high but isolated hill covered with forest, on which a house has been built, which is occasionally occupied by the missionaries from Toungoo during the hot weather. At the foot of this hill, near a small perennial stream, are some flourishing betel-palm gardens. On this march we visited the (Christian) Karen village of Tapan choung, situated like Kyouk-O in the eng forest.

The camp was in the forest, on the left or eastern bank of the Te-poo choung, the northern branch of the Youk-thawa river, a beautiful perennial stream which rises in the hills. On this march we saw a considerable quantity of teak, and the following is a brief account of the teak between Kyouk-O and our camp on the Te-poo choung.

### Forests on the Tapan and Te-poo Choungs, Youk-thawa District.

342. The country near the road which leads from Tantaben *vid* Thabieh to Kyouk-O contains only a few scattered teak trees. The road leads through mixed forest, through the paddy-fields of the Burmese villages of Thabieh and Changyee and of the Karen village of Sin-mee-do, and enters an eng forest near the Goon-nway Pagoda, a few miles west of the last named village. At the Karen village of Kyouk-O teak commences, and it is found near the banks of streams and on low hills which intervene between the extensive

stretches of eng forest, which here occupies the greater portion of the country. The best teak is found near the banks of the following streams: Singjan, a feeder of the Kyouk-O stream, a tributary of the Youk-thawa, Mayteindein, a northern feeder of the Youk-thawa stream, its tributary the Tapan choung, and the Te-poo choung, the northern chief branch of the Youk-thawa stream. The rock on the hills is gneiss and hard quartzose schist, with laterite in the eng forest.

Between Kyouk-O village and the Te-poo choung the teak trees were counted: *first*, between the Singyan choung and Tapan village, a distance of four miles, of which one mile was through the fields of the Karen village of Toung-gyee; *second*, from Tapan village to Tapan choung, 3 miles; *third*, from Tapan choung to Te-poo choung, 3 miles, chiefly through eng forest. Near the camp at the Te-poo choung are a number of young trees with fine, tall, well-shaped stems, 3 to 5 feet in girth.

The following were the trees counted:

| | I. Class. | II. Class. | III. Class. |
|---|---|---|---|
| | Trees above 6 feet in girth. | Trees from 4 feet 6 inches to 6 feet. | Trees from 18 inches to 4 feet 6 inches. |
| First survey ... ... ... | 29 | 32 | 24 |
| Second „ ... ... .. | 107 | 63 | 60 |
| Third „ ... ... ... | 7 | 4 | 2 |
| Total ... | 143 | 99 | 86 |

The width of the track on which the trees were counted was on an average about 100 feet. The first class trees predominate, and the trees of the smaller classes are not abundant. Regarding the character of the larger-sized trees, the same remark applies which is recorded in the description given of the Youk-thawa forests in the Pegu Forest Report for 1859-60 (paragraph 49). The growth of the trees is neither straight nor regular, the stems are fluted, and they are frequently forked and branched. The bamboos associated with teak here are wa-nöe (called wa-pyoo in the Khaboung forest) with single strong branches, tin-wa, a little kyathoung-wa, and thaik-wa on diluvial soil near the streams. Pyinkado, gwayben, zimbyoon, myoukshaw, and near the streams kanyin and thingadoe, were noticed.

Of the teak trees above six feet in girth counted, only about 10 per cent. would be fit to girdle and to yield marketable timber. Lower down the streams mentioned, the larger trees are said to be better grown, and the forest should be examined. The trees below six feet in girth are well grown, and will mostly give valuable timber, provided they grow up without fires. But fires are extremely fierce in these forests; they do much damage to the older trees, and in many cases they are the chief cause of unsound and badly-shaped stems.

When officers are available for a systematic examination of the Youk-thawa forests, the best teak localities should be selected, to be strictly preserved and protected against fire. This will do more to improve this forest than any other measures that could be devised. The number of stumps is very large, probably about three or four times the number of first class trees. They are all old and are said to date from the Burmese times. There is evidently no difficulty in working this forest. From the portion near Kyouk-O village, the timber has been dragged into the Thouk-ye-gat stream, while, from the forests further east, the timber has been floated down the Te-poo choung.

**Bullock road into the hills.**

343. The road which we followed to-day and further on, as far as Plü-mü-doe, is the road used by traders who go up into these hills to purchase betel-nuts, the leaf of the betel vine, fruit, particularly oranges and

sweet limes; and who take up in return salt, ngapee, dried fish, and other merchandise. This trade is mostly carried on by Shan traders, who go up with their bullocks, and hence the road is generally known as the bullock road into the hills. Before crossing the Te-poo choung the road divides—the road followed by us going to the Myit-ngan valley by the head-waters of the Te-poo choung, while another branch leads to the head-waters of the Choung-ma-ngai further north. Both the Choung-ma-ngai and the Myit-ngan are tributaries which join the Thouk-ye-gat river from the south side. But the paths which lead up the valleys of those rivers are impracticable for bullocks, and so the trade routes have to cross the outer range of hills in order to enter the valleys of those rivers. There are other bullock roads which tap the hills south of the Thouk-ye-gat river, and perhaps the most important is that which leads from Toungoo *vid* Myatsaw-neenoung (the Seven Pagodas) and Payllowa-zaik to Bo-ga-lay, and from that place to Karennee.

**Te-poo Choung to Te-poo Village.**

344. *Wednesday, 25th February.*—The road leads first over a series of dry hills, clothed with stunted eng forest. Here, as well as in the eng forest through which we passed yesterday, are sheds and huts built by Shans, who come here during the rains to graze their bullocks. Through this eng forest, and through all the forest to the westward, jungle fires pass regularly every year during the hot season; but as we ascended higher into the toungya grounds of Bimbay village, we entered a region where jungle fires are strictly excluded. In these hills, if any one sets fire to the forest through carelessness or mischief, the villagers claim and enforce the payment of heavy damages. After entering the hills which are thus protected against fire by the people, we passed through the areas of two large villages, Bimbay and Te-poo. They are as well defined in these hills as they are anywhere in India, and the boundaries of these village areas are most jealously guarded. This, however, applies only to that portion of the hills which is used for toungya cultivation. The vast extent of forest which occupies the higher ranges, above an elevation of 3,500 feet, is not appropriated by any village, because it is considered unfit for toungya cultivation. Nor is the forest in the lower hills or in the plains appropriated. Here any one who chooses and is the first on the ground may cut a toungya, or clear the ground for permanent cultivation; whereas on the higher hills, in that part of the country to which the present remarks relate, all ground fit for toungya cultivation is permanently occupied, and if outsiders wish to cut toungyas they can only do so under arrangements with the owner of the land. On the hills through which the road led us this day, the toungya clearings had mostly grown up in bamboos, and the period which is allowed for the bamboo forest to grow up before it is cut again varies here from seven to fifteen years.

**Betel-palm gardens.**

345. The valleys of the numerous feeders of the Te-poo choung, which drain these bamboo forests, are occupied by flourishing betel-palm gardens wherever there is water and sufficient soil. These gardens are most carefully irrigated and weeded. The plants are generally put out six feet apart, and, as they rather like shade while young, blanks caused by trees which have died or are too old to yield are planted up at once. It takes from three to five years before the plant forms a regular stem, and after that about five nodes with leaves are produced every year. As the leaves fall, they leave circular scars or rings, so that by counting these rings, which remain a long time visible on a stem, the age of the tree can approximately be determined. The plants commence to bear when about 10 years old, and when in full bearing they often produce two to three flower stalks, each with 40 to 50 nuts. But these beautiful trees are subject to disease like other plants, and in many instances whole bunches of nuts dry up or become otherwise diseased and useless. A tree in good bearing is said to yield a viss of green nuts a year. The price varies with the distance from the market from Rs. 50 to 80 for 100 viss of dry nuts, and about half that

rate for green nuts. Before the nuts are sold, the thick orange coloured rind is first removed. The betel-palms in these hills are not generally as tall as those further south on the hills between Shwaygeen and the Yoonzaleen river and between the Yoonzaleen and Salween. But I saw many trees 60 to 80 feet high, and in all cases the nuts are plucked by climbers with the aid of long bamboos. Some of these Karens who own betel-palm gardens are probably the most skilful and bold climbers in the world.

Under the betel-palms, mangoes, the Mayan—a small acid mango, but produced by a different tree, with smaller opposite leaves (*Bouea oppositifolia*)—the jack-fruit, guavas, and a great variety of other fruit trees are planted, among which are six kinds of limes, citrons, and oranges. Plantains and pine-apples are also common; but most of this fruit is locally consumed, and a few kinds only, such as oranges, sweet limes, and mayan, are sold and exported.

We camped in a betel-palm garden belonging to Te-poo village. The village itself consists of several distinct hamlets, which are situated high up on the hills above the valleys, the valleys being extremely feverish.

#### Te-poo to Sindangyee Village.

346. *Thursday, 26th February.*—The road crosses the head-waters of the Te-poo choung, and then ascends rapidly to the ridge which divides the Te-poo stream from the feeders of the Myit-ngan. On the top of this ridge is a narrow belt of forest, which has not been touched by the toungya-cutter's axe, and from this belt narrow bands of original forest extend along the ravines and valleys which descend on the east towards the Myit-ngan and on the west towards the Te-poo river.

On a clear day, early in the dry season, the hills of the Pegu Yoma, west of the Sitang river, are seen from this ridge, and a comparison of the conditions under which the Karens live on these two hill ranges naturally suggests itself. On the Pegu Yoma also there are vast areas covered with secondary growth, which has sprung up on deserted toungyas. But these toungya grounds are separated by large areas of forest, which has either never been touched, or which has had time to grow up again into high forest. On the whole of the Pegu Yoma, from the frontier to its southern end, 30 miles north of Rangoon, a length of 160 miles with an average width of 40 miles, the Karen inhabitants probably are not more numerous than the Karens who occupy the hills drained by the southern feeders of the Thouk-ye-gat—the Kyay choung (Blaillo, Karen), the Myit-ngan (Jollo), and the Choung-ma-ngai (Soalo)—an area only 20 miles long and 18 miles broad.

Hence, while on these hills south of the Thouk-ye-gat river land is scarce and the toungya grounds have to be most carefully managed, the Karens on the Pegu Yoma wander where they list and cut their toungyas wherever their fancy, or the marks which they find on the bones of fowls, lead them to. On the eastern hills, if the forest available for toungya cultivation is fired, the hope of good crops is destroyed for many years; while on the Pegu Yoma the Karens delight in setting fire to the forest, knowing that they have vast areas to roam over, from which it rests with them to choose the best places for their toungya clearings.

Sindangyee is a large and almost entirely Christian village, consisting of three hamlets. We camped in that hamlet which is called Kyoung-tsoo, because the chapel is in it. The point where the road crosses the ridge is probably about 3,000 feet high; it is called Kway-tsa Sakan, the story being that many years ago there was a fight between the people of Te-poo and of Sindangyee, caused by a boundary dispute, and that at the end of the fight the inhabitants of the two villages made peace on the boundary by eating a dog together.

The village where our camp was, has an excellent situation, about halfway between the ridge and the bed of the Myit-ngan river, which may here be estimated to flow at an elevation of 1,000 feet above the sea. It is exposed to the morning sun, while the ridge behind shelters it from the afternoon sun; and altogether it is an excellent and most healthy situation.

### Sindangyee to Plü-mü-doe.

347. *Friday, 27th February.*—The road descends gradually to the Myitngan river, which it crosses at a point considerably above Sindangyee. Then follows a stiff and hot ascent to Plü-mü-doe. Shade on these hills there is none, except here and there, where the road leads along the bed of a stream, through one of the narrow belts of forest which fringe the stream, or through the betel-palm gardens, which are numerous, admirably kept, and are everywhere being extended wherever the soil is good enough and water available for irrigation. Higher up, near the ridge, the forest growth which comes up on deserted toungyas consists of bamboos in some and of young trees and shrubs in other places; but as this growth is cut down once in seven or eight years, it does not grow sufficiently tall to shade the road. Lower down near the river, where the jungle is cut down once in five years, nothing but shrubs and tall grasses spring up. Old gnarled and pollarded trees are left standing, as their branches, which are pollarded when the toungyas are cut, increase the ashes required to make the paddy grow. A few vegetables are planted in moist and sheltered places; otherwise these toungyas produce nothing but paddy. Where the rotation is short, the people are most thankful if an abundant crop of a tall reed (*Arundo* sp.) grows up, as the stalks of this grass yield a good supply of ashes. Cotton, which is an important addition to the crop of paddy on the hills of the Pegu Yoma, only attains a small size here and yields a poor crop, so that it is not much cultivated.

### The Toungya grounds permanently occupied.

348. Everywhere the people were busy in cutting their toungyas. One village generally cuts four or five large blocks, each block belonging to a number of proprietors. The toungya grounds of each village consist of a large number of these blocks, a few of which are cut every year. The headman, after consulting the chief proprietors, determines which blocks are to be cut. Well-to-do proprietors own from 20 to 30 plots, situated in different parts of the village area. These plots are sold and bought just as the plots of betel-palm gardens. When a proprietor dies, his landed property, be it garden land or toungya ground, is divided in equal shares among his children.

It thus may happen that a proprietor owns no plots of toungya land in the blocks selected this year for cutting and burning. If so, he makes an arrangement with other proprietors and rents some of their plots for the year, the rent being generally paid in kind. The most remarkable feature in this rather complicated arrangement is that boundary disputes are not very numerous. For the boundary marks are most imperfect, and though the forest growth which grows up on the toungyas, after the crop has been reaped, is not high, it is quite impenetrable. The boundaries between the different plots, therefore, can only be recognized when the block is cut and burnt in its turn.

To-day's march took us through the lands of Sindangyee and Zin-bon, another village higher up the stream, but on the same side of the valley. Here an old teak tree was pointed out as the boundary mark between the two villages. It was explained to me that the plots belonging to different proprietors are sometimes marked by shallow furrows drawn along the slope, but I am inclined to think that these must be hopelessly obliterated by every monsoon. Yet I was assured that boundary disputes between different proprietors of the same village are not common. I confess that I do not understand how this is managed. I have here spoken of the people as the proprietors of their toungya grounds. They, however, only claim a kind of imperfect proprietary right. They hold their lands as against the other proprietors of the village, but they recognize that the State has a superior right in the land.

### Teak in the valley.

349. As far as Plü-mü-doe teak is common on the lower slopes on both sides of the valley; and on steep and rocky ground, where toungyas cannot be cut, tall and well-grown trees may be seen, and these have profited by the

protection from fire which this valley enjoys. Under the authority given by the forest rules of 1856, the hills to which the present remarks relate were exempted from the restrictions prohibiting the cutting of toungyas in teak localities: whenever, therefore, teak trees stand on toungya grounds they are pollarded when a toungya is cut, and hence nothing but half-burnt and mutilated stems remain in such places. But where toungyas have not been cut, the teak trees are here as elsewhere regarded by the people as the property of Government; and in a poor country like this every additional opportunity of earning money would be welcomed by them. Hitherto the teak of the Myit-ngan valley has not been made available for export on account of some large rocks which obstruct the river a few miles above its mouth. But such obstructions existed formerly in most rivers of Pegu which drain the teak forests, and they have mostly been removed by continued blasting operations, which, with few interruptions, have been carried on since 1858. The gneiss, which is believed to be the principal rock of which these obstructions are formed, is hard, but doubtless it will be possible to remove the obstructions, and this should be done as soon as time and money for such work are available. The first step will be to examine the river and the teak which remains in the valley, to determine what outlay on this account would be justified.

Plü-mü-doe has its name from a former headman of the place. Another story is that a Karennee or Shan robber chief of that name was killed here. The Burmese call it Pyoungmoodoe, but it is more correct to use the Karen name.

### Plü-mü-doe to Ta-epo.

350. *Saturday, 28th February.*—The camp at Plü-mü-doe was at a beautiful place, the site of the old village, under clumps of huge bamboos of the large kind called Wa-bo(——), which is commonly planted by Karens all over these hills, as in the Yoonzaleen district and in the pine forests east of the Salween watershed. It is not often that it is possible to get shade for a camp in these hills, unless it is pitched at the bottom of the valley, where the risk from fever is great.

The village area of Plü-mü-doe is bounded on the west by the river and on the north and south by two streams, but to the east the boundary is undefined. The area here extends into the virgin forest which occupies the high range, separating the valleys of the Myit-ngan and Kyay choungs. This forest is regarded as unfit for toungya cultivation, and is hence untouched and not appropriated. A few bullocks and buffaloes are bred for sale at Plümüdoe, but they have abundant pasture in the lower part of the valley, and the forest above their villages is not used in any way by the people. The houses are built entirely of bamboos, and in the rare case that a piece of wood is wanted there are trees enough near the streams to furnish it.

The area fit for toungya cutting at Plü-mü-doe is confined; the rotation is from five to seven years and in places it is less. But the village is better off than Bo-ga-lay and the villages in the immediate vicinity of that place, where toungyas have to be cut in the same place once every three to five years.

Bo-za-chee, the next village up stream east of the river, has a larger area, and Ta-epo and Jochi, at the head of the valley, have an abundance of land, so that here clearings are only made once in 20 years, and at longer intervals near the upper limit of toungya cultivation.

The road from Plü-mü-doe to Ta-epo descends to the Myit-ngan river, and follows it upwards to its bifurcation. The northern branch, or Blüllo, descends from the vicinity of Nat-toung, the Tsotsi-ko of the Karens, while the southern branch, which retains the name of Jollo, flows parallel with the Prello, one of the two main branches of the Yoonzaleen, being separated from it by a high and narrow ridge which is called Boothee-ko.

**Permanent fields should be made on terraces.**

351. At the junction of these two streams, as well as lower down all along the bottom of the Myit-ngan valley, there are considerable areas of gentle slope, which, with a little terracing, might easily be made into permanent paddy-fields, where each acre would yield as much paddy as many acres of toungyas. In similar places, the Nepalese make excellent paddy-fields in their own country, as well as in the hills of British Sikkim and in the Dumsong district. The wild Nagas have terraced nearly the whole of their hills south of the Assam Valley, and the Shans and Karennees could not live in their countries if they did not terrace the hill sides. On many occasions I have explained this to the Karens who inhabit these hills, and eventually necessity will doubtless compel them to exert themselves to build terraces, to level and irrigate their fields. Hitherto no progress has been made in this direction.

The main objection raised by the Karens against the plan is that the soil in the Karennee country is a stiff loam, and that the soil in their hills is too light to retain water. Excellent paddy-fields, however, exist on similar soil in the Himalaya, both in the Darjeeling district, east of the Teesta river, and in the North-West Himalaya. The magnificent paddy-fields of Kulu are all on soil of similar description.

The junction of the two main branches of the Myit-ngan river is probably about 1,500 feet high, and from here a long and stiff ascent through shadeless toungyas took us to our camp below Ta-epo village, on one of the feeders of the Blullo river. The camping ground was without shade. Though at an elevation of about 3,000 feet, the sun during the day was extremely fierce, and owing to the vicinity of the stream the dew at night was very heavy.

**Ta-epo to Sidee.**

352. *Monday, 1st March.*—The boundary between the Toungoo and Shwaygeen districts is on the Boothee-ko ridge, at an elevation of about 4,500 feet. The ascent to this point is gradual, and in its upper part the road leads through pine forests, which give a pleasant shade Here the elegant *Rhododendron* with large white flowers (*Rh. Moulmeineuse*, Hook.) was found, an arborescent *Vaccinium* was abundant, and a great ornament with its graceful racemes of pink and white flowers; *Brainea-insignis*, the remarkable cycas-like fern, with short stem and stiff pinnate fronds, forming the underwood under the pines. The ridge which here separates the two parallel valleys of the Jollo (Myit-ngan) and Prello (Yoonzaleen), flowing in opposite directions, is extremely narrow, and in one place there is a high precipice down to the Myit-ngan river. But elephants pass without any difficulty. I had sent messengers across to the Karens of the Yoonzaleen valley, who came most willingly and cleared the road for my elephants as far as Lomatee.

Crossed the Prello and ascended on the east side of the valley, camping near Sidee village.

**Sidee to Layllo.**

353. *Tuesday, 2nd March.*—The march down the valley was short but fatiguing, as it was a succession of steep ascents and descents into the numerous tributaries of the Prello. A peculiar feature in the Yoonzaleen valley is the deep-black mud in all ravines and valleys. For foot-passengers there are rude bridges, but elephants and ponies sink deep into the mud, and great care is necessary.

The Layllo is a rapid mountain stream, which comes down straight from the Nat-toung. It joins the Prello a few miles below the camp.

**Layllo to Lomatee.**

354. *Wednesday 3rd and Thursday 4th March.*—Two short marches, descending the valley of the Yoonzaleen, after crossing the shoulder of a hill from the Layllo stream. Before reaching Lomatee the road ascends a ridge between the river and the Cholo, a tributary from the east, and then joins the bullock road from Karennee, half a mile north of Lomatee. Paddy-fields all along the Cholo, and the whole valley inhabited. In 1859 it was a desert,

with scarcely any villages. That was after the unfortunate insurrection under Minloung. Now the old people and their descendants have returned. A large extent of level ground along the Yoonzaleen, which might be turned into permanent paddy-fields. Some tea plants at Lomatee, not flourishing; but the site is too dry. Tea and cinchona might be tried with irrigation in the Yoonzaleen valley, above Lomatee, if the Karens could be induced to cultivate them. The wild tea, which however is altogether a different plant, is collected and used extensively by the Karens. The long dry season from November to April is against the success of tea and cinchona cultivation by Europeans in these hills. The yield would be too small to pay. But the Karens might be induced to grow them.

No betel-palms in the Upper Yoonzaleen valley, nor will the tree grow either here or at the head-waters of the Myit-ngan or Kyay choung. The frost is too severe. Tea, however, stands frost, and its cultivation by the Karens should be encouraged.

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## CHAPTER XII.

### SALWEEN.

#### Upper Salween Forests.

355. The Upper Salween forests were examined by me in March and May 1859, and a brief account of them will be found in paragraph 17 (pages 13—18) of the Report on the Tenasserim Forests for the two years 1858-59 and 1859-60. My visit in 1880 was from the 8th to the 15th March. The rules of 1865 were not extended to these forests. Those of 1876 were made applicable to the area comprised between the Boothee-ko range on the west and the Salween river on the east. To the north the forests are bounded by the Pah choung (being the boundary of British territory), while to the south a line has been drawn west from the mouth of the Thoungyeen river to the Yoonzaleen watershed. No teak worth mentioning is found south of this line.

#### Working.

356. These forests were not worked under the authority of Government until 1860, and the returns of the Moulmein Forest Office do not show any timber outturn from them previous to that year. It is, however, probable that trees were girdled and that timber was exported from these forests ever since they became British territory, and that this timber was brought to Moulmein under the name of Karennee and Shan timber. From 1860 to 1865 the forests were worked under annual permits, the operations of the permit-holders being confined to old girdled timber and to the trees girdled by the Department, which are reported to have been as follows:

| | | |
|---|---|---|
| In 1861-62 | ... 1,200 | trees. |
| „ 1862-63 | ... 656 | „ |
| „ 1863-64 | ... 172 | „ |
| TOTAL | ... 2,028 | „ |

In 1866 the forests were leased out, with permission to girdle all trees in girth above 5 feet, the lease extending over six years. Similar leases for six years were again issued in 1871; but in the case of the third division, or Maitharouk forests, the permit was cancelled on account of the failure of the permit-holder to bring out any timber during a whole year. The latter forests have since 1874 been worked by Government contractors. The total yield of the Upper Salween forests since 1860 has been as follows:

| | Logs. | Tons. |
|---|---|---|
| By permit-holders, old seasoned timber and trees girdled by Government, until 1865 ... ... ... | 6,821 | 5,455 |
| By lease-holders authorized to girdle green timber above 5 feet in girth, 1866 to 1877 ... ... ... | 23,878 | 19,046 |
| By Government contractors (Maitharouk only), from 1874 to 1879 .. ... ... ... | 2,633 | 2,160 |
| TOTAL ... | 33,332 | 26,661 |

If this outturn is compared with the outturn of some of the forests in Pegu during the same period, it will at once be seen how limited the teak-

producing tracts in the Upper Salween are, although they are spread over an area 60 miles long and (on an average) 12 miles wide, and although the leaseholders had permission to girdle all mature trees. Thus the Mokka and Beeling forests in the Tharawaddy district, which occupy an area of not more than 150 square miles, have within the same period yielded 48,000 logs, containing 39,000 tons, although a small proportion only of the mature timber was girdled, the forest being worked on strict conservancy principles with the view to its improvement.

**Limited extent of teak-producing forest.**

357. The explanation is this, that the Boothee-ko range, which bounds the Upper Salween forests on the west, rises to an elevation of 3,000 feet, and that a considerable portion of the country between that range and the Salween river attains an elevation exceeding 2,000 feet. At these elevations teak is at a disadvantage in the moist climate of the Upper Salween. In the drier climate of the hills on the feeders of the Thouk-ye-gat river, east of Toungoo, teak ascends to an elevation of 2,500 feet ; but the climate of the hills east of the Boothee-ko range is much more moist than that of the Toungoo hills, and hence teak is here limited to dry ridges and slopes in the lower hills.

On the more elevated ridges, and along the numerous perennial streams which descend from the Boothee-ko range towards the Salween river, there are vast extents of evergreen forest, in which teak cannot live. Moreover, a large portion of the hills at a lower elevation than 2,000 feet is covered with bamboo forest without any teak trees. Some of these hills may at one time, before cultivation commenced, have been stocked with teak. But if teak was ever found there, it has long ago disappeared under the axe of the toungya cultivator. The Boothee-ko range does not extend north of the Solo or Myin-tabyee choung ; and here a much wider belt of lower hills intervenes between the Salween river and the high pine-clad ranges which give rise to the Pah choung and to the eastern feeders of the Yoonzaleen. But these hills are all occupied with eng forest, teak being limited to the lower slopes; while at the bottom of the valleys, and along ravines, there are frequent stretches of evergreen forest.

**Area of teak localities diminished since 1859.**

358. In the Report quoted, the area of the teak localities in the Upper Salween forests is given at 106 square miles. This estimate, however, was probably too favourable at the time, and certainly now no longer holds good. When it was framed, the country had been deserted by its inhabitants after the Minloung Rebellion of 1856, and there were only a few villages left, the total population of which was at that time estimated by me at not more than 600 souls. Since 1859 most of the old inhabitants and their descendants have returned to the district, and other immigrants have come. All these people have cut toungyas on a large scale, and many of these toungyas have been made in the best teak localities.

Until 1876 no separate forest rules applied to the Salween district, and the small amount of protection which teak received previous to that period was based upon the fact that ever since this part of Martaban became British territory, on the annexation of Pegu in 1852, teak was regarded as a royal tree. The rules of 1876, which, as already mentioned, apply to the Upper Salween forests, give authority to form and declare reserved forests ; such reserved forests to be protected, as far as protection can be enforced without abridging or affecting any existing rights of individuals or communities ; while in the rest of the forest to which the rules apply, the marking, cutting, girdling, or injuring of teak trees, as well as the cutting of toungyas in teak-producing tracts, is prohibited.

No reserves have, however, yet been selected and declared in the Upper Salween forests.

**Toungyas prohibited in teak-producing tracts.**

359. The rule prohibiting the cutting of toungyas in teak-producing tracts was, as far as I understand from the Conservator, not notified in the

district until 1878, and has certainly in no way been generally enforced. Toungyas have been formed, and are formed indiscriminately in teak localities; and on our tour we saw many places in which teak trees in toungyas had been felled, burnt, or mutilated.

Two cases of cutting teak in the Maitharouk forests were last year brought before the District Court at Papoon, and the offenders were fined Rs. 50 each; but if all cases in which the rule has been transgressed were to be punished, prosecutions would have to be instituted against the inhabitants of most villages in that district. Under these circumstances, it clearly is not expedient to enforce these rules over the whole of the district mentioned, and obviously the only plan to pursue is to demarcate and declare as reserved forests a limited area of the more valuable teak localities. After this demarcation has been completed, the rule prohibiting the cutting of toungyas in tracts containing teak may then be cancelled.

Under the rules of 1876, teak, catechu, pyinkado, and thingan are reserved trees, but no attempt has ever been made to enforce the protection of any of these, except teak, in the Upper Salween forests. Under these rules the Chief Commissioner was also authorized to declare any other trees beyond those mentioned to be reserved, but none have thus been declared. All these facts point to the necessity of limiting interference with trees and timber, except for purposes of trade and export, to certain limited tracts, which should as soon as possible be declared reserved forests.

**Diminution of growing stock.**

360. It has already been mentioned that the area of the teak-producing tracts in the Upper Salween district has been considerably diminished by toungya cultivation. In addition to this, the value of these teak localities has been greatly impaired by the operations of the lease-holders, who worked these forests for nearly twelve years, with the permission to girdle every tree above 5 feet in girth. It may be estimated that about 20,000 trees were girdled by the lease-holders.

In 1859 the forests contained large quantities of teak. Excluding some surveys which were not quite reliable, there were counted in that year, by the writer of the present Report, in the Upper Salween forests on four square miles, or 2,560 acres—

| | Trees. |
|---|---|
| First class, 6′ girth... ... ... | 1,580 |
| Second „ 4′ 6″ do. ... ... ... | 1,053 |
| Third „ 1′ 6″ do. ... ... ... | 2,569 |
| TOTAL ... | 5,202 |

and of these were counted in the Maitharouk forest on 0·334 square miles, or 213·76 acres—

| | Trees. |
|---|---|
| First class, 6′ girth . ... ... | 315 |
| Second „ 4′ 6″ do. ... ... ... | 121 |
| Third „ 1′ 6″ do. ... ... ... | 283 |
| TOTAL ... | 719 |

These surveys are recorded on page 202 of the Attaran Report of 1860.

Of all this timber very little is now left.

Mr. Aplin, Assistant Conservator of Forests, has recently been engaged in girdling trees, the timber of which is to be extracted by Government contractors. His operations have been confined to a portion of the Maitharouk valley, where he has girdled 289 trees, nearly all situated on the hills between the Maitharouk and its eastern feeder, the Oo-doo choung. The only trees fit to girdle were found in rocky places unfit for toungya cultivation. The

rock is chiefly the grey limestone of Martaban, resting on hard argillaceous schist, and the soil is a stiff grey or red loam. On these hills between the Maitharouk and Oo-doo choungs teak is exceedingly numerous; but wherever the slopes are easy and the soil suitable, toungyas have been formed, and the teak has been cut, burnt, or mutilated. Nevertheless, there can be no doubt that if these hills are protected, the forest will recover and will in time be exceedingly valuable.

**Maitharouk reserves proposed to be demarcated.**

361. At present we contemplate the demarcation as a reserved forest of the hills between the Maitharouk and Oo-doo choungs, extending north to the Met-tha-law choung. In this area eight villages cut toungyas, viz., four on the Maitharouk and four on the Oo-doo choung. But all these villages are situated on the outskirts or outside, and they cut a portion of their toungyas outside the tract proposed to be demarcated. One of the villages, Lamoohay, has a large extent of wet paddy cultivation; and the area fit for such cultivation, both along the Maitharouk and Oo-doo choungs, and along some of their feeders, is very considerable.

Moreover, the tract here mentioned is surrounded on all sides by large extents of forest as yet untouched by toungya cultivation, in which no teak is found. So that the inhabitants of the villages concerned would have no difficulty in finding land outside these limits available for toungya cultivation. The Government Forest Act of 1865, under which the rules of 1876 were framed, stipulates that the notification of Government forests shall not abridge or affect any existing rights of individuals or communities; and whatever the provisions of the new Forest Act proposed to be passed for Burma may be, it will be necessary that all such rights be inquired into and that compensation be given for any such rights.

**Rights to be dealt with at the time of demarcation.**

362. In some portions of the hills between the Sitang and Salween rivers, particularly in those hills which are situated immediately east of Toungoo and are drained by the feeders of the Thouk-ye-gat, the Karen population is so dense that toungyas are cut on a limited area, in short rotations of seven, five, and in some cases even of three years. In these tracts each village has its well-defined boundaries, and any encroachment of these boundaries by another village or by outsiders is resisted. In some of these tracts the land available for toungya cultivation is even sub-divided into numerous plots, in which plots private occupancy rights are recognized. In the tracts where such a state of things exists, the greatest care is used to prevent the firing of the forest; and in such cases private rights in land used for toungya cultivation must, as a matter of course, be recognized. But such a state of things will on enquiry not be found to exist in the Upper Salween forests. From all I have been able to ascertain, it seems clear that the villagers in this district shift their toungya grounds, as they do in the hills of the Pegu Yoma.

Village areas, bounded by definite and generally recognized boundaries, do not exist, nor are there any recognized occupancy rights in the toungya grounds of private individuals.

Betel-palm gardens and plots of wet paddy land are of course private property, but such lands will in no way be affected by the demarcation of forests. They will remain as private enclosures within the reserved forests, and the exercise of the rights held in them will in no way be affected by the measures here advocated.

**Requirements of the people to be dealt with at the time of demarcation.**

363. Nevertheless, the requirements of the villages located in and around the proposed reserve in the matter of land conveniently situated for their toungya clearings, must be met; and if such should appear necessary, areas for toungya cultivation must be demarcated within the reserve.

Outside the area here described, a considerable quantity of teak exists on the hills west of the Maitharouk river, all round Lamoohay village; and there is teak east of the Oo-doo choung, and on both sides of the Maitharouk

below its junction with that river. Very fine teak is also reported to exist on the range at the sources of the Oo-doo choung, which is at present supposed to be impossible to work at remunerative rates on account of the difficulty of the ground and the distance from the river. A further examination of the forest must show whether any of these localities may be included within the area now proposed to be reserved.

I am of opinion that the areas which can be demarcated as reserved forests should at once be selected, and that after the preliminary selection has been made by the Forest Officer, the settlement of rights should be made by the Civil District Officer in communication with the Forest Officer.

**Proposed Paylio Reserve.**

364. Another tract which I desire specially to mention is that situated between Kolodo and the Pah choung. In this tract, as far as teak goes, there are only two villages—one near Kolodo, and the other on a feeder of the Paylio (Padee choung, Burm.), north of the stockade. These villages can doubtless easily be provided for, and the remaining area may then be demarcated as a reserved forest. The soil on the feeders of the Paylio and Pah choungs is excellent, and the teak grows well and attains a large size. This area may be designated as the Paylio or Padee choung Reserve.

**Other Reserves proposed.**

365. Other areas recommended to the attention of the officers charged with the work of preliminary selection are the forests drained by the Solo or Myin-tabyee choung, south of Kolodo, and the hills on the Salween river, below Dagwin-zaik, which in 1859 were found to be stocked with excellent teak forest. I have suggested to the Conservator that the first work to be taken in hand should be the examination of the entire Maitharouk valley as far as it contains teak; and that the next area to be examined should be the forest between Kolodo and the British boundary.

**General Remarks.**

366. In the settlement of rights, and in the arrangements to provide for the requirements of the Karen villages situated within the reserves here proposed to be formed, the following points must be borne in mind: *First.*—The area available for wet paddy cultivation in the Upper Salween forests is very large. On our tour we came across permanent paddy-fields in terraces on the head-waters of the Bloma and Mehnoo, on the head-waters and in the valley of the Maitharouk, as well as on the May-yaik, a large western feeder of the Maitharouk. We have also seen places which were formerly under wet paddy cultivation, and which are now deserted; and the area available for permanent cultivation on terraces is very extensive. The soil is a binding rich loam, with much vegetable mould, and is extremely favourable for permanent paddy cultivation. Some of the stretches of paddy, fields surrounded by hills covered with forest, carefully terraced and irrigated, resemble the fertile valleys of Coorg and the western coast of India, where the hills are as high and steep as here and where the climate is similar. In some of those districts toungya (there called "kumri") cultivation is almost extinct, or is confined to a few remote valleys; and yet a large population maintains itself in comfort by wet paddy-fields, which occupy every valley.

There is a large expanse of country, forming a kind of terrace or long narrow plateau, on the east side of the Boothee-ko range, which is drained by the May-yaik, the head-waters of the Maitharouk, and the Mehnoo and Bloma streams, and the elevation of which probably averages 2,000 feet. Here on the more gentle slopes, which are very extensive, it is not impossible that permanent fields of Indian corn, and perhaps also of wheat, might be made. This stretch of high ground maintains a large population in a number of villages, but it might maintain a very much larger number if the area of permanent fields were increased. Even with the present system of toungya clearings, a larger population than now exists might live on these cool and fertile highlands, for the area of forest untouched by toungya clearings is still very considerable.

367. The *second* point is that the exercise of any prescriptive rights, in regard to the land which may have existed previous to Minloung's rebellion, was interrupted by the depopulation of the country after that unfortunate event, and that numerous new settlers, who have come from beyond the frontier or from other parts of British territory, have within the last ten or fifteen years established themselves in this part of the country.

If all these points are duly taken into consideration, it will probably not be found difficult to secure for Government complete control over a few selected teak-producing tracts. While examining the forests in March last, we considered the question whether it would not be preferable, after demarcating these areas, to leave matters *in statu quo*, merely to enforce the rules within the demarcated areas, and not to enforce them outside their boundaries. But after weighing the arguments on both sides, we have come to the conclusion that it will in every way be best at once to effect a complete settlement of all rights, and at once to provide for the requirements of the existing population outside the reserves. To permit toungya cultivation within their limits, provided that teak localities are spared, would involve control and watch over the whole area, which, if effective, would be extremely difficult and expensive. Moreover, the people residing within the limits of the area selected would have just reason to complain that they were subjected to the strict enforcement of the forest rules, whilst others were exempted from their operation.

These considerations have induced us to recommend that the preliminary selection should at once be followed by a detailed enquiry and final settlement of rights.

In a difficult country like that to which the present remarks relate, the work of demarcation and settlement of rights cannot be finished in a short time, but will probably require several years. During this period the existing forest rules should not be held in abeyance, but should be enforced with discrimination, the Forest Officer acting under the advice and control of the Civil District Officer.

**Bamboos.**

368. The Upper Salween forests are rich in a great variety of magnificent bamboos, of which it must suffice to name a few of the most important kinds. Wa-klü (Kyello-wa of Burmans; *Dendrocalamus Brandisii*) forms extensive forests on the higher ridges and along valleys and ravines. The stems of this bamboo are often more than 100 feet long, with a girth of 22 inches. It is extensively used in building Karen houses, for the roof, posts, walls, and flooring. Wa-bgai (Tabendein-wa of Burmans; *Bambusa villosula*) is common above a certain elevation, extending in places to near the crest of the Boothee-ko range. It clothes most hill sides used for toungya cultivation, where it covers the ground completely to the exclusion of other trees. It is much smaller than wa-klü, the stems when full grown attaining a length of 50 feet and a girth of 10 inches; but tabendein-wa forests being the favourite localities for toungya cultivation, there are no large areas stocked with full grown stems. This kind is well marked and readily distinguished from all others by the distinct stems, which come up separately and do not form dense clusters as most other species. Another peculiar character is that the stems are completely naked and branchless in the lower part. The stems are bright green, often with yellow stripes, and the leaves are bluish and soft velvety to the touch on the underside. Kyathoung-wa, tin-wa, and myin-wa, which are the chief bamboos associated with teak in Pegu, are also found on the Upper Salween hills wherever teak occurs. On the dry limestone rocks myin-wa is the usual companion of teak; while tin-wa is common where the ground is more moist and less rocky; and kyathoung-wa is met with on some of the hills in the immediate vicinity of the Salween river. Teak is occasionally found associated with wa-klü, but hardly ever with wa-bgai, which, with the aid of the periodical toungya clearings, almost entirely kills out all tree vegetation.

**Other trees.**

369. The value of the Upper Salween forests chiefly consists in the teak timber which they produce. The excellent soil of these forests shows itself in the well-shaped and tall stems, wherever cutting and firing have not mutilated them. The timber from the Upper Salween has a good name, and is believed to be of very good quality. This is the chief ground upon which the recommendation now made to demarcate reserved forests in this district is based. But besides teak there are other trees which merit attention. The chief is a kind of thitkado, called "*toung-da-ma*" by Burmans and "*nee*" by Karens. The tree is probably *Cedrela multijuga*. The heart-wood has a light red colour, with the scent of cedar wood, and at times there is a demand for this wood in Moulmein. As the timber floats readily when felled green, there is no difficulty in bringing it down the rapids of the Salween river, and it should be exported on Government account whenever there is a prospect of finding a sale at Moulmein. The tree is chiefly found near the banks of streams, and is thus not much affected by toungya cultivation. It attains a girth up to eight feet, with tall cylindrical stems, and young trees are numerous.

**Paper Mulberry.**

370. The Paper Mulberry (*Broussonetia papyrifera*) is another valuable tree common in these forests. The inner bark is used for making card-boards, called "Palabaiks," and for the manufacture of a very fine description of paper of which the Burmese umbrellas are made, and which is used for packing. Near Lamoohay village, on the banks of the Maitharouk river, we found a manufactory of this paper conducted by Shans. A hundred sheets are sold on the spot for two rupees. The manufacturers pay no revenue at present, either to the Karens or to the Government, but they can well afford to pay a royalty, which at first might be fixed at two rupees per cauldron per mensem. The bark is boiled in iron cauldrons, with a lay of wood-ashes, and afterwards beaten on stones with wooden mallets and made into small balls, one of which yields a sheet of paper 26 inches square.

The paper mulberry is an extremely valuable tree; the Tapa cloth of the South Sea Islands is made of its bark; in Japan it yields paper, and is there grown as coppice wood. As soon as a Forester is located in the Upper Salween district, an attempt at planting it on a large scale in toungyas should be made. The tree has been found by the writer of the present Report on the Maitharouk, on the highlands at its source, in the valley of the Solo choung near Kolodo, and (in 1859) further north near the Pah choung. It is said to be common all over the district.

The following account of the paper mulberry in Japan, taken from the *Paper-Makers' Monthly Journal* of the 14th August 1880, shows that the tree might with advantage be grown as coppice wood :

The *Broussonetia papyrifera*, called Kodzu by the Japanese, is extensively cultivated throughout the empire of Japan; it thrives best on dry sunny slopes, and is propagated by cuttings. About three years are allowed to elapse before gathering the first annual crop, which is done about November by cutting off the shoots close to the ground. These are cut into short lengths and steamed in huge iron pots, so as to loosen the bark. This bark is stripped off, the outer dark-coloured rough skin is scraped off and used for the coarser qualities, and the finer parts are washed, kneaded, and then bleached in the sun. The last is boiled in a lye, made from the ashes of buckwheat straw generally, to free it from gummy or resinous matter, and is then well pounded between stones or with mortars, some of which are worked by water in districts where such power is to be obtained. The fibres now being separated, the knotty portions are removed, and the pulp resulting is steeped in pure water mixed with mucilage, obtained from the bark of *Hydrangea paniculata* and the root of *Hibiscus Manihot*.

Regarding its excellant qualities for paper manufacture, a passage from the Report of the Royal Gardens at Kew for the year 1879 may be quoted—

The bark of the well-known paper mulberry supplies the material from which the Tapa cloth of Polynesia and the bulk of the paper of Japan and China is manufactured. The Japanese cultivate the plant very much in the same way that we grow osiers, and they use only the young shoots for the manufacture of paper. A sample of the bark which

came into the hands of Mr. Routledge is stated by him to be "nearly, if not quite, the best fibre I have seen." * * * "I must admit it is even superior to bamboo." * * * "It requires very little chemicals, and gives an excellent yield—62·5 per cent. in the grey, *i. e.*, merely boiled, and 58 per cent. bleached."

**Sinzway Forest.**

**Area—Boundaries.**

371. The Sinzway forest was examined by me in April 1859 and again in March 1862, and a brief account of it is given in paragraph 14 of the Tenasserim Forest Report for the two years 1858-59 and 1859-60 and in paragraph 14 of the British Burma Report for 1861-62. It was declared a reserved forest in 1871 and was demarcated in 1872.

The reserve measures 8,960 acres, and occupies a stretch of hills and undulating ground about 6 miles long and 3 miles wide, which runs parallel with the Yoonzaleen river. The north-eastern boundary is a range of hills half a mile to one mile distant from the main river, but at one point, viz., at the mouth of the Koon choung, a narrow strip of ground extends to the bank of the Yoonzaleen. To the north it is bounded by the Gwaythay choung, and to the south and west by the Sinzway and the feeders of the Shoke choung. Wherever the boundary does not run along a stream, a line from 6 to 10 feet wide has been cut, which is kept open by annual clearings. Wherever the boundary, be it a stream or other line, is crossed by a path, boundary boards are put up, and such boards are also placed where a path runs along the line. It is intended to put up boards everywhere around the entire reserve.

**Three parallel belts.**

372. An excellent bird's-eye view of the whole forest is obtained from a high point about three-quarters of a mile west of the mouth of the Koon choung, on the line of watershed which separates that stream from certain smaller streams that fall directly into the Yoonzaleen. Standing on this point, several belts running parallel to the Yoonzaleen river can be clearly distinguished. The easternmost of these belts consists of a mass of steep and irregular hills separated by deep valleys, through which run streams with rocky beds. The hills are clothed with bamboo forest, chiefly consisting of tabendein-wa, and where the slopes are not too steep they are all from time to time cleared for toungya cultivation. Along the streams and on steep rocky slopes there are stretches of evergreen forest. This belt is about a mile wide, counting from the Yoonzaleen.

The second belt, which runs parallel to the first and south-west of it, is a broad stretch of undulating ground drained by the Sinzway and some of the western feeders of the Koon choung. In this belt bamboos are more mixed with trees, and here teak is abundant, although there are patches of forest in which teak is wanting.

In this central tract of the reserve, which is about two miles broad, numerous large trees of Kanyin *(Dipterocarpus)* are found, which tower high above the surrounding forest. Two trees as average samples were measured and gave the following dimensions:

| | No. 1. Feet. | No. 2. Feet. |
|---|---|---|
| Total height ... ... ... ... | 171 | 165 |
| Height to first branch ... ... ... | 82 | 110 |
| Girth ... ... ... ... | 17 | 18 |

Thingan is also not uncommon.

A third belt is west of the Shoke choung, and it consists of hills mostly stocked with bamboos and here and there with teak. These hills are the toungya grounds of the Karen villages on the Kanyin-doon choung, a large tributary of the Yoonzaleen, which runs parallel with and west of the Shoke choung.

The central belt is the chief seat of teak, which is abundant on the higher and drier portions.

**Growing stock—Teak.**

373. The following are the results of the valuation surveys made at different times in this tract:

**Valuation Surveys.**

| Years. | Area surveyed. | No. of teak trees counted. | | | | Trees on 100 acres. | | | | Officer by whom the survey was made. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Class I. | Class II. | Class III. | Total. | Class I. | Class II. | Class III. | Total. | |
| | Acres. | | | | | | | | | |
| 1859 ... | 57 | 286 | 230 | 80 | 602 | 502 | 414 | 140 | 1,056 | D. Brandis. |
| 1862 ... | 208 | 536* | 418 | 349 | 1,303 | 257 | 201 | 168 | 626 | D. Brandis. |
| 1869 ... | 55 | 115 | 94 | 186 | 395 | 209 | 171 | 338 | 718 | Major Seaton. |
| 1880 ... | 42 | 90 | 148 | 155 | 393 | 214 | 352 | 369 | 935 | D. Brandis and Major Seaton. |

* Includes 160 trees girdled in 1862.

The surveys of 1859 were made in the richest portion of the forest, and the numbers then counted do not admit of comparison with the later surveys. In order to understand the later surveys it must be borne in mind that the following numbers were girdled between 1862 and 1871. In 1862, 1,200 trees. The surveys held that year were made after the trees had been girdled, but the first class trees counted include a proportion of trees girdled during that season. In 1863-64, 700 trees were girdled; in 1869-70, 334; and in 1870-71, 1,000 trees. In 1859 the total area of teak localities in the Yoonzaleen valley was estimated at 12 square miles, with 29,352 first class trees. No separate estimate was made for the Sinzway forest, and without a more detailed and accurate map than we possess no such estimate can be attempted at present; but it is probable that the teak localities in the Sinzway forest do not cover less than 6 square miles or, say, 4,000 acres. On this area 3,234 first class trees have been girdled since 1859, and, considering the figures of the valuation surveys, it seems probable that during the 20 years which have elapsed since 1859 the trees removed have been replaced by the smaller trees, which during that time have attained a girth of 6 feet. At the same time, the number of the smaller classes has increased considerably.

The data furnished by the valuation surveys here quoted relate to an area much too limited to justify our making an estimate of the number of first class trees now remaining in this forest. A topographical and valuation survey of the forest was commenced in 1880, with the view of framing a preliminary working plan. This survey would doubtless be most useful, but, owing to other more pressing work, its completion had to be postponed. Speaking broadly, the first class trees left standing in the Sinzway forest are irregularly shaped and branched, and many of them have been hopelessly injured in former years by fire. Yet a number of the trees will yield good marketable timber. The large increase in the number of trees below 6 feet in girth is the most satisfactory feature in this forest, and shows that protection generally has been efficient. The trees below 6 feet in girth have not stems as round and regularly shaped as the trees of similar size on the shale and sandstone of the Pegu Yoma; but the stems are sufficiently regular to yield marketable timber, and in some cases good lengths were noticed. Thus one tree, which measured 5 feet 4 inches in girth, had a stem 70 feet long to the first branch. This agrees with what is recorded regarding the stature of the trees in the Report for 1861-62.

**Other trees and bamboos.**

374. With teak are associated principally pyinkado, myoukshaw, and some of the other trees common in dry deciduous forests; toukkyan is scarce, and was only noticed in a few places where the soil was a

stiff clay. The bamboos associated with teak are chiefly wa-gouk, which, not being tall and erect like the other species generally found with teak, but forming dense low masses of nearly horizontal stems bending over, is not useful in drawing up the young teak trees, and does not therefore tend to make their stems tall and straight. Tin-wa is common in places, and here and there myin-wa is found. Wa-ya is abundant and very large near streams, but in such localities teak is scarce. There are, however, exceptions : thus Mr. Aplin reports a small tract of teak with wa-ya north of the Myin-tabyee and Kanyin-doon road, and the wa-ya in this case has drawn up the younger teak trees, which on this account are particularly fine.

**Rate of growth of teak.**

375. We had no opportunity of examining the annual rings of teak, no trees having lately been felled; but there seems every reason to believe that the rate of growth of this tree is not slower here than it generally is in Burma; on the contrary, it is probable that it will be found to grow more rapidly. As soon as fresh fellings are made, the annual rings should be counted, the mean diameter and girth being measured. The climate of this forest is very moist and forcing. We found the dew exceedingly heavy throughout the reserve during our visit from the 18th to the 20th March 1880, on high ground as well as in the valleys. The soil is a rich loam with much vegetable mould, and the underlying rock being partly limestone, partly hard argillaceous shale, there is a great variety of soil, which is doubtless beneficial for the growth of teak.

**Fire protection.**

376. The teak in the Sinzway reserve has been more or less protected since 1859. Fire protection was first attempted in 1871, and successfully continued until 1877, when, in April of that year, nearly the whole reserve was burnt. This was done by a man residing in one of the villages in the vicinity, who had quarrelled with Yoo-po, the late Forest Goungway. The man was fined by the Magistrate at Papoon, and there has been no mishap since. There is a large extent of dry and rather open forest, with high grass, to the south of the reserve, which is fired every year. Fire also is apt to spread from the banks of the Yoonzaleen. Until 1877 the Forest Guard in charge managed the whole fire protection with the aid of the people of his village. This was effected by means of narrow fire-traced lines and counter fires where necessary. There is no danger from the north and north-east, as the toungyas of the villages on the Kanyin-doon river and between the reserve and the Yoonzaleen river are protected by the people.

**Outer fire-lines.**

377. Since 1877 a more efficient but more expensive system has been adopted. This consists of a broad fire-trace 50 feet wide, running all round the southern and a portion of the eastern boundary, from Yoo-po old village to the mouth of the Koon choung. A similar line has been made along the Papoon road where this road forms the eastern boundary. Where these broad lines have been cut, it will be best to clear and burn them every year, leaving however all trees standing which have not already been girdled or cut, and allowing teak to come up along the lines. Where the lines have not yet been cut, I advocate that we should be satisfied with a boundary path six feet wide, which should be so laid as to make it easy to walk along. Where the ground along the boundary lines is impracticable, deviations must be made. If found more convenient, this path might be widened to ten feet, and should be swept clean during the dry season. It will be understood that such a path will be shaded, and it will be well to preserve a belt of forest 30 feet wide on either side, where toungya teak plantations should not be made.

**Inner fire-lines.**

378. Three internal fire lines have already been cut to a width of about 30 feet, viz., 1st, the Myin-tabyee and Kanyin-doon road, traversing the northern part of the reserve in a south-west direction; 2nd, from Yoo-po old village to the mouth of the Koon choung; 3rd, the old Papoon high road where it runs through the reserve in a south-east direction.

These three cleared lines run along frequented paths, and should be burnt and cleared every year like the outer fire lines. In addition to these, it is proposed to clear a path running through the reserve, from the Kwaythay choung past the Nonabo Eng to the Sinzway choung. This path should be cleared to a width of six feet, and eventually perhaps of ten feet, like the paths already mentioned.

**Local Establishment.**

379. The establishment consists of one Forest Guard on Rs. 12 a month, who resides inside the reserve. During the fire season two watchers are entertained to assist him. They are chiefly employed to watch the southern boundary and to give intimation of the burning of toungyas inside and outside the reserve.

**Burning of teak toungyas.**

380. Besides the risk of fire from the outside, there is considerable risk lest the fire should spread from the toungyas cut for planting teak inside the reserve. In 1879, in all 20 toungyas were cut inside, and this year permission has been given to cut 30 toungyas situated in five large blocks in different parts of the reserve. These toungyas are always fire-traced, and up to the present time no accident has happened. When the toungyas are fired, the whole village assembles and the portions of each block are fired consecutively with the aid of all the people of the village. In the Reports for 1859-60 and 1861-62 the great injury done to the teak in the reserve by the annual jungle fires was specially noticed. Great improvement has already been effected by the partial protection which the reserve has enjoyed since 1871. But at the same time large quantities of inflammable matter have accumulated, and if unfortunately a fire should occur, the damage done to the teak would be enormous. The greatest care will therefore have to be paid to fire protection in this forest during the next few years. Eventually it may be expected that here as elsewhere the character of the forest will change under continued fire protection, and that fire conservancy will thereby be much facilitated.

**Toungya teak plantations.**

381. Much has been done in the Sinzway reserve in the matter of planting teak in toungyas; and on the 31st March 1879, 384 acres of toungya teak plantations were reported to exist in this forest. I have examined a large proportion of these plantations, and the result is as follows:

**1879.**

The plantations of 1879 have not been very successful. There are plants in most toungyas, but they are few, and there are large blanks without a single plant. The teak plants are so scattered that there is much risk of their being suppressed by the bamboos. We examined plantations of that year, both near the Pat-chee-law choung in the east of the reserve, as well as near Pakalomeh village on the Sinzway stream in the centre of the reserve, and the result was the same. Major Seaton examined the same plantations in September last; in places he found 200 plants to the acre from one to ten feet high, but so irregularly scattered that it will be extremely difficult to prevent their being smothered by the much more rapidly growing shoots of the tabendein-wa. The shoots of this bamboo of the same year are twenty feet high. The indifferent success of the operations of 1879 is accounted for by the heavy rainfall in April of last year, which lasted ten days without interruption. Hence the firing of the toungyas was incomplete, and this had a bad effect upon the growth of both paddy and teak.

**1878.**

In March we examined the plantations of 1878, near Pakalomeh village and on the Pat-chee-law choung. One toungya cut near Pakalomeh village had been cut in wa-gouk; the trees were four to six feet high and some were up to 13 feet. The other jungle was principally grass 15 feet high. Near the Pat-chee-law choung the teak plants were particularly fine on the lower slopes, and on an average six feet high, though some had attained 13 feet. Higher up on the hills they were overtopped by kaing grass, bamboos, and coppice shoots

of other trees. The teak was only four to six feet high, while the bamboos (tin-wa) had already attained a height of 20 feet. It was here noticed that a large proportion of the plants had come up with double stems; this is explained by the custom of putting several seeds into each hole.

**1875 to 1877.**

382. The plantations of 1877, 1876, and 1875 were examined near the Pat-chee-law choung. Those of 1877 were very good in tabendein-wa ; well stocked on lower parts and fairly on higher. Trees vigorous, with clean bark, long shoots of 1879 and in some cases of 1878. Average height of the larger plants about 15 feet and some 30 feet. On the hill the trees were shorter, but even here trees 20 feet high were observed. The following statement shows the total height of four trees measured with the length of the shoots of 1878 and 1879:

| Total height. | Shoot of 1878. | Shoot of 1879. |
|---|---|---|
| 20 feet. | 8 feet. | 10 feet. |
| 18 do. | 7 do. | 10 do. |
| 20 do. | 8 do. | 8 do. |
| 30 do. | 9 do. | 15 do. |

The plantations of 1876 have been less successful. The plants were not numerous, and the dense thicket of tabendein bamboo which had grown up with them had overtopped them. The majority of the trees were three feet high, a few only being up to ten feet. The bark not clean, covered with moss and lichens.

The most satisfactory feature in the plantations of 1876 was that the shoots of 1879 were generally long, six to eight feet; and it is to be hoped that eventually some of the trees will push through the bamboos and overtop them. Near the road leading to the mouth of the Koon choung, a toungya of the same year, with some fine saplings 12 to 15 feet high, was observed.

The plantation of 1875 was almost an entire failure, the trees being only two to three feet high and not numerous.

**Older plantations.**

383. A much older plantation of 1870 or 1871 (age not quite certain), on the dragging path which leads from the head waters of the Sinzway to the Koon choung, was examined. Its extent is small, but it is well stocked, the trees being on an average 10 feet apart. The mean height of the trees was 60 feet, and the mean girth of the dominant trees 20 inches, which is in every way satisfactory. It is surrounded by wa-ya, but there is no bamboo among the teak trees. There are other plantations of about the same age in the northern and western part of the forest, which are reported to be in a satisfactory condition.

These older plantations, as well as those of 1876 and 1878, prove that the system of toungya plantations has a good chance of success in the Sinzway forest, provided due care is taken to clear the teak while young. In no forest district in Burma have I seen the terminal shoots of the last few years so tall and so vigorous; and if fires are excluded, the rate of growth of the teak in the Sinzway forest will probably be extremely rapid. The poor success of 1879 was entirely due to the unfavourable season, while the unsatisfactory state of the plantations of 1875 and 1876 was due to the fact that sufficient attention was not paid to keeping the plants clear afterwards.

But so much is certain, that out of the 384 acres reported to be stocked with teak, a portion only is likely to be well stocked when the trees grow up.

**Toungya teak plantations to be limited.**

384. The greatest care will have to be employed to guard against the system of toungya teak plantations being abused by the people who cut the toungyas, and I would suggest the following modifications in what I understand to be the present practice.—In no case should the people, in my opinion, be invited to plant teak in their toungyas, and permission to make toungya teak plantations inside the reserve should only be given sparingly. As a rule,

it should be given to those people only who are old residents in the reserve, and who undertake the responsibility of clearing the plantation continuously during the first three years after planting. The permission to cut toungyas in the reserve should be regarded as a privilege, to be conceded to those only who have earned this privilege by strict attention to the rules laid down in this respect.

**Planting in lines.**

385. In order to facilitate a satisfactory dealing with this business, I am of opinion that in Sinzway, as well as in other reserves of the Tenasserim Circle, it will be well to adopt the plan of planting in lines.

Of late years the planting distance has been 9 feet, giving an average area of 81 square feet to each plant if the toungya is completely stocked. I am of opinion that, in order to diminish the risk of the plants being overtopped by weeds and bamboos, the planting distance must be diminished, and would suggest that the seed be sown in lines 12 feet apart, the plants within the lines being at a distance of four and a half feet. This will give an area of 54 square feet for each plant on an average, and will therefore entail a somewhat heavier outlay at the outset; this however is unavoidable. It certainly is better to have a smaller area well stocked, than a large area of toungya ponzohs without teak, or with very little teak.

In order to facilitate the work, the lines may, at first at least, be run uphill, although horizontal lines would be preferable. The payment made for the plants raised during the rains may, as at present, be made at the rate of Rs. 8 per 1,000 plants, the seed being, as hitherto, furnished by the Department.

**Subsequent clearing.**

386. For the subsequent clearing of the plants another arrangement should be adopted. At present the Karens who cut the toungyas do not generally in the Sinzway forest undertake the clearing of the plants, although they do it in other forests, and most of this work is done by hired labour. In future, no permission to cut toungyas should, in my opinion, be granted in the Sinzway reserve, unless the persons formally undertake the responsibility to clear the toungyas planted by them during the first three years; and the payment to be made for clearing should be fixed at a certain rate for every hundred feet well-stocked. It will be necessary to define the term well-stocked; and it will probably suffice to say that a line 100 feet long should have not less than 15 trees, and that these should be distributed fairly uniformly. The present custom is to clear the lines before the rains commence, this being considered more useful than after the rains. But it will rest with the Karens to clear the plantations at such times as may best ensure the growth of the teak planted. The advantages of planting in lines in this case are obvious. The system simplifies the clearing and facilitates control. In case of failures not caused by circumstances beyond the control of the cultivators, such as unseasonable rain and other calamities, it will be well to let it be understood that only those who have been successful in the work of planting and clearing will receive permission to cut toungyas inside the reserve. When the reserve was formed, the late Goungway, Yoo-po, lived on the borders of the reserve with four or five families. They were permitted to cut toungyas in the reserve on condition of their planting teak, and subsequently other people were permitted to come into the reserve also. None of the present inhabitants have any rights in the reserve, and if they do not choose to abide by the conditions laid down they must take the consequences. Great care should, however, be used not to make these alterations suddenly and without due warning. Thus, for the present year, it will be necessary to continue the existing practice, but all cultivators should be warned that from 1881 the new system will be introduced.

**Wamoo Reserve.**

387. This reserve is situated about three miles north of Papoon, on the left bank of the Yoonzaleen river. Its western boundary is the river; its eastern boundary runs along the outer slopes of the Boothee-ko range. Its area is 1,920 acres. The high road from Papoon to Kolodo passes through it,

and the road to Kyouknyat forms its northern boundary for a short distance. The eastern portion is hilly, while near the river there is a narrow belt of level or undulating ground on either side of the road. Teak is found both on the hills and in the level portion, but not everywhere. The large trees are badly shaped, owing chiefly to mutilation by toungya cutting and fires. Some of the smaller trees also on the level ground have irregularly-shaped stems, while on the hills the stems are better shaped. The reserve was demarcated in 1871, and attempts to protect it from fire have been made since 1877.

A fire line about 15 feet wide has been cut along the southern boundary, where it is necessary and should be maintained, as fires come up from Papoon. No fires come from the hills, and it is believed the northern side is safe, but there is great risk of fire from the high road and from a large hollow teak tree with combs of wild bees. The high road can without difficulty be fire-traced, and the tree with the beehives should be cut down.

**Toungya teak plantations**

388. The first toungyas for the purpose of planting teak were made in 1877, and a small number of good plants is the result. This year (1880) one toungya was cut, but the result is a failure. The plants were there after the rains, but were destroyed by buffaloes. This year a party of Shans have come in, and have cut a large area in the forest, with the intention of making permanent paddy-fields. The case was sent to the Assistant Commissioner in charge of the Salween district, but dismissed by him, because the Forest Guard stated he had given permission to cut the toungyas. Hitherto it appears that the Forest Guard had authority to grant permission to cut toungyas on condition that teak was planted. This of course must be put a stop to at once, and it must be clearly understood that permission to cut toungyas must only be given by the divisional officers.

For the present, what this reserve requires most, is protection from fire. It would be well to plant teak in toungyas, but it will be necessary to observe the same precautions which have been suggested for the Sinzway forest. The practice which I found to exist when I visited the reserve in March last is thoroughly unsatisfactory, and practically amounts to this, that the forest is thrown open to unrestricted toungya cultivation.

**Kaheeloo Forest.**

389. This reserve is situated on the right bank of the Yoonzaleen, about ten miles above its junction with the Salween river. On the north side it extends to the Teepado choung, a large feeder of the Kanyin-doon. The western boundary is the range of hills which separates the Yoonzaleen and Doomdamee valleys, and to the south the reserve extends to the Wakailo, a feeder of the Yaiboo choung, a tributary of the Yoonzaleen. Its area is 9,600 acres, and it was demarcated in 1878. The boundary is marked by boards nailed on trees and by a cleared line.

The ground is level, except in the centre and near the western border. Bamboo forest is on the banks of the Teepado and on low hills at the source of the Soolo; but with this exception the entire reserve is stocked with moist evergreen forest, in which, as far as we know at present, thingan and thitka are the most valuable trees. Before the reserve was demarcated, considerable quantities of thitka were extracted from the eastern part of the forest, near the Yoonzaleen river. Many large trees, however, remain, and seedlings as well as young trees are numerous. The tree attains a large girth, and forms tall well-shaped stems. Thitka is found both in the evergreen and in the drier forest on the outskirts of the evergreen. Thingan is even more abundant than thitka.

One Forester is in charge of the reserve, and he has managed to protect it against fire since it was demarcated, by clearing a fire-trace along the southern and south-eastern boundary line. The reserve does not anywhere touch the Yoonzaleen river, which is a great drawback, as it may render the working of the forest difficult. There are no villages near the main river, between the Soolo and Oono choungs, and here an extension should be made, so as to give the forest a river frontage. This is essential.

There are extensive cane brakes on low ground in this forest, and some revenue may be expected from the sale of canes.

**Shwaygoon plantation.**

390. In 1856 a large nursery, measuring 4½ acres, was established by Mr. Gemmer, then Superintendent of the Tenasserim forests, on the east bank of the Salween river, 50 miles above Moulmein, near the village of Shwaygoon. The trees were not transplanted, except a small number which were planted in an avenue along the road from Shwaygoon to Kannee. In April 1859 the largest trees had attained a height of 18 feet.

The locality was examined by me in company with Major Seaton on the 21st March 1880. The soil is a poor light sandy loam, which dries up rapidly, and the trees were all leafless at the time of our visit.

The trees in the avenue are badly grown, with short irregularly-shaped stems, dividing into branches at 10 to 15 feet from the ground. The upper branches are all covered with seed panicles, and the trees do not look vigorous. They were on an average 60 feet high, with a mean girth of 49 inches, the largest girth being 62 inches.

In the plantation where the trees had grown close together, they were somewhat taller, with straight and better-shaped stems, having, however, a tendency to branch near the top. The tallest tree measured 69 feet, and the average was about 65 feet. The girth of the dominant trees in the plantation was between 16 and 30 inches, the average being 24 inches. But the trees had grown up very close together and had impeded each other's progress. The border trees, which had more room, had an average girth of 36 inches; the largest girth being 50 inches.

The plantation should be thinned, which would certainly improve its growth, but it is doubtful whether the thinnings would cover the expense. On the west side the plantation is bounded by the river, on the south by a large orchard with Poongyee kyoungs, and on the east by a road Its protection, therefore, is not difficult, and it should be formally placed in charge of the headman of the village, who should be made responsible for its protection against fire and cutting.

**Conclusion.**

391. This plantation is instructive in so far as it shows the growth of teak in a dry locality and on poor dry soil, but the result in no way encourages the formation of plantations in the open country on the banks of the Salween river. The monsoon is heavy enough here, but the dry season from November until May is long, and the air during this season is very dry. There is very little dew, the sun is exceedingly fierce, and evaporation very rapid. The teak grows and will probably produce good timber, but the growth is much slower, and the shape of the stems much less regular, than higher up the river near the hills, in the better-wooded part of the country.

The contrast between the rate of growth of teak at Shwaygoon in the open dry country, and at Thingan-neen-noung in the midst of the moist evergreen forest at the head-waters of the Attaran river, is remarkable. Against a girth of 24 inches and a height of 65 feet at an age of 24 years at Shwaygoon, we have at Thingan-neen-noung a girth of 30 to 48 inches and a height of 80 feet. There is probably no great difference in the mean annual rainfall of these two places; but the difference consists in this, that at Thingan-neen-noung the soil is extremely rich and the dry season is not scorching as it is at Shwaygoon.

# APPENDICES.

## Statement I.

*Imports and exports of teak timber, Rangoon and Moulmein,* 1856-57 *to* 1878-79, *in tons of* 50 *cubic feet.*

| Years. | Imports of teak timber. | | | | | Exports of teak timber. |
|---|---|---|---|---|---|---|
| | From foreign territory. | | | From British territory. | Grand Total. | |
| | Into Rangoon (by the Irawaddy and Sitang Rivers). | Into Moulmein (by the Salween River). | Total. | | | |
| 1856-57 ... | 5,831 | 67,629 | 73,460 | 19,066 | 92,526 | 44,812 |
| 1857-58 ... | 2,523 | 46,610 | 49,133 | 12,732 | 61,865 | 68,805 |
| 1858-59 ... | 3,810 | 41,138 | 44,948 | 20,462 | 65,410 | 89,682 |
| 1859-60 ... | 5,930 | 43,357 | 49,287 | 13,888 | 63,175 | 67,097 |
| 1860-61 ... | 12,829 | 48,875 | 61,704 | 22,095 | 83,799 | 58,721 |
| 1861-62 ... | 6,084 | 70,675 | 76,759 | 24,304 | 101,063 | 108,744 |
| 1862-63 ... | 4,816 | 63,262 | 68,078 | 35,899 | 103,977 | 90,405 |
| 1863-64 ... | 13,299 | 62,382 | 75,681 | 32,952 | 108,633 | 85,843 |
| Total ... | 55,122 | 443,928 | 499,050 | 181,398 | 680,448 | 614,109 |
| Average ... | 6,890 | 55,491 | 62,381 | 22,675 | 85,056 | 76,763 |
| 1864-65 ... | 16,820 | 66,029 | 82,849 | 19,301 | 102,150 | 136,666 |
| 1865-66 ... | 30,501 | 70,947 | 101,448 | 37,919 | 139,367 | 143,110 |
| 1866-67 ... | 14,540 | 41,327 | 55,867 | 31,310 | 87,177 | 67,089 |
| 1867-68 ... | 12,439 | 61,264 | 73,703 | 32,865 | 106,568 | 78,470 |
| 1868-69 ... | 14,278 | 62,625 | 76,903 | 52,258 | 129,161 | 114,766 |
| Total ... | 88,578 | 302,192 | 390,770 | 173,653 | 564,423 | 540,101 |
| Average ... | 17,716 | 60,438 | 78,154 | 34,730 | 112,884 | 108,020 |
| 1869-70 ... | 11,436 | 40,721 | 52,157 | 39,843 | 92,000 | 91,975 |
| 1870-71 ... | 15,169 | 67,315 | 82,484 | 57,086 | 139,570 | 80,135 |
| 1871-72 ... | 17,066 | 81,343 | 98,409 | 52,125 | 150,534 | 86,944 |
| 1872-73 .. | 17,377 | 60,650 | 78,027 | 39,698 | 117,725 | 115,001 |
| 1873-74 ... | 25,155 | 101,402 | 126,557 | 39,633 | 166,190 | 116,418 |
| Total ... | 86,203 | 351,431 | 437,634 | 228,385 | 666,019 | 490,473 |
| Average ... | 17,241 | 70,286 | 87,527 | 45,677 | 133,204 | 98,095 |
| 1874-75 ... | 32,167 | 133,746 | 165,913 | 37,910 | 203,823 | 115,806 |
| 1875-76 ... | 46,620 | 166,330 | 212,950 | 46,554 | 259,504 | 156,039 |
| 1876-77 ... | 42,228 | 117,170 | 159,398 | 47,433 | 206,831 | 114,090 |
| 1877-78 ... | 59,140 | 149,049 | 208,198 | 51,381 | 259,579 | 156,198 |
| 1878-79 ... | 51,399 | 119,211 | 170,610 | 35,397 | 206,007 | 130,681 |
| Total ... | 231,563 | 685,506 | 917,069 | 218,675 | 1,135,744 | 672,814 |
| Average ... | 46,313 | 137,101 | 183,414 | 43,735 | 227,149 | 134,563 |
| Grand Total ... | 461,466 | 1,783,057 | 2,244,523 | 802,111 | 3,046,634 | 2,317,497 |

# Statement II.

*Teak trees girdled in, and teak timber brought from, the forests in British Burma, 1856-57 to 1878-79.*

| Forest. | Trees girdled. | | | Timber extracted during 23 years, 1856-57 to 1878-79. |
|---|---|---|---|---|
| | 12 years, 1856-57 to 1867-68. | 11 years, 1868-69 to 1878-79. | Total. | |
| | | | | Tons. |
| **Pegu Circle.** | | | | |
| *I.—Western Forests* ... ... | ..... | ..... | ... | 64,945 |
| *II.—Eastern Prome.* | | | | |
| (1) Boolay and Choungoungyee ... | 3,523 | 1,902 | 5,425 | 16,498 |
| (2) Nawing and Choungzouk ... | 24,748 | 7,098 | 31,846 | 21,048 |
| (3) Royal Forest ... ... | 385 | ..... | 385 | 1,186 |
| Total ... | 28,656 | 9,000 | 37,656 | 38,732 |
| *III.—Tharawaddy.* | | | | |
| (1) Shaboung ... ... | 5,808 | 3,029 | 8,837 | 7,544 |
| (2) Shwaylay ... ... | 13,563 | 7,404 | 20,967 | 22,169 |
| (3) Toungnyo ... ... | 14,175 | 4,632 | 18,807 | 21,803 |
| (4) Minboo and Kangyee ... | 8,679 | 1,000 | 9,679 | 12,414 |
| (5) Boben ... ... | 15,178 | 2,017 | 17,195 | 26,829 |
| (6) Toungchoung ... ... | 1,708 | 2,002 | 3,710 | 12,332 |
| (7) Gamoong, Kadot, and Ngapiin ... | 14,217 | 2,008 | 16,225 | 21,217 |
| (8) Minhla ... ... | 6,290 | 4,025 | 10,315 | 18,370 |
| (9) Mokka ... ... | 4,839 | 1,003 | 5,842 | 11,924 |
| (10) Koon and Kadin Beeling ... | 25,672 | ... .. | 25,672 | 32,454 |
| (11) Thoonzai ... ... | 18,979 | 4,015 | 22,994 | 10,013 |
| (12) Miscellaneous ... ... | ..... | ..... | ... | 908 |
| Total ... | 129,108 | 31,135 | 160,243 | 197,977 |
| *IV.—Rangoon.* | | | | |
| (1) Oukkan ... ... | 16,342 | 1,000 | 17,342 | 6,027 |
| (2) Magayee ... ... | 5,076 | 1,000 | 6,076 | 2,659 |
| (3) Maizulee ... ... | 3,875 | ..... | 3,875 | 535 |
| (4) Pounglin .. ... | 250 | 2,000 | 2,250 | 4,256 |
| (5) Zamayee and Pegu ... ... | 17,624 | 2,000 | 19,624 | 28,894 |
| Total ... | 43,167 | 6,000 | 49,167 | 42,371 |
| *V.—Sitang.* | | | | |
| (1) Myohla ... ... ... | 659 | 4,766 | 5,425 | 13,730 |
| (2) Swa ... ... ... | 15,785 | 250 | 16,035 | 28,272 |
| (3) Khaboung ... ... | 10,676 | 67 | 10,743 | 12,237 |
| (4) Ilpyoo ... ... ... | 7,166 | 168 | 7,334 | 12,616 |
| (5) Koon ... ... ... | 5,936 | 6,053 | 11,989 | 12,984 |
| (6) Bawnee ... ... ... | 2,260 | 4,000 | 6,260 | 4,320 |
| (7) Bimbyay and Gwaythay ... | 2,919 | 4,954 | 7,873 | 16,331 |
| (8) Koonoong ... ... | 8,376 | 218 | 8,594 | 14,313 |
| (9) Kaunee ... .. | 7,445 | 1,000 | 8,445 | 9,733 |
| (10) Thouk-ye-gat ... ... | 4,373 | 1,500 | 5,873 | 17,845 |
| (11) Youk-thawa ... ... | 5,294 | ..... | 5,294 | 5,354 |
| (12) Moong and Padah ... ... | 5,828 | 3,099 | 8,927 | 11,812 |
| (13) Doonzaroet and Shwaygyeen ... | 59 | ..... | 59 | 1,679 |
| (14) Miscellaneous .. ... | ..... | ..... | ... | 1,292 |
| Total ... | 76,176 | 26,075 | 102,251 | 162,518 |
| Total, Pegu Circle ... | 277,107 | 72,210 | 349,317 | 506,543 |
| **Tenasserim Circle.** | | | | |
| *VI.—West Salween.* | | | | |
| (1) Beeling ... ... | 1,003 | 2,000 | 3,003 | 3,075 |
| (2) Doomdanee ... ... | 2,822 | 2,000 | 4,822 | 6,992 |
| (3) Yoonzaleen ... ... | 1,900 | 1,674 | 3,574 | 3,778 |
| (4) Upper Salween ... ... | 2,028 | ..... | 2,028 | 26,661 |
| Total ... | 7,753 | 5,674 | 13,427 | 40,506 |
| Carried over ... | 7,753 | 5,674 | 13,427 | 40,506 |

*Teak trees girdled in, and teak timber brought from, the forests in British Burma,* 1856-57 *to* 1878-79,—concluded.

| Forest. | Trees girdled. | | | Timber extracted during 23 years, 1856-57 to 1878-79. |
|---|---|---|---|---|
| | 12 years, 1856-57 to 1867-68. | 11 years, 1868-69 to 1878-79. | Total. | |
| | | | | Tons. |
| Tenasserim Circle,—*concluded.* | | | | |
| Brought forward ... | 7,753 | 5,674 | 13,427 | 40,506 |
| *VII.—East Salween.* | | | | |
| (1) Lower Salween ... ... | 527 | ..... | 527 | 19,866 |
| (2) Pandaw ... ... | ..... | ..... | ... | 22,698 |
| (3) Hlinebway ... ... | 300 | 226 | 526 | 11,757 |
| (4) Houndraw ... ... | ..... | ..... | ... | 282 |
| (5) Thoungyeen ... ... | 5,743 | 8,934 | 14,677 | 133,314 |
| Total ... | 6,570 | 9,160 | 15,730 | 187,917 |
| *VIII.—Attaran* ... ... | ..... | ..... | ... | 30,064 |
| Total, Tenasserim Circle ... | 14,323 | 14,834 | 29,157 | 258,487 |
| Drift timber ... ... ... | ..... | ..... | ... | 37,081 |
| Grand Total .. | 291,430 | 87,044 | 378,474 | 802,111 |

## ABSTRACT.

| Divisions. | Trees girdled. | | | Timber extracted during 23 years, 1856-57 to 1878-79. |
|---|---|---|---|---|
| | 12 years, 1856-57 to 1867-68. | 11 years, 1868-69 to 1878-79. | Total. | |
| | | | | Tons. |
| Pegu Circle. | | | | |
| I.—Western Forests ... ... | ..... | ..... | ... | 64,945 |
| II.—Eastern Prome ... ... | 28,656 | 9,000 | 37,656 | 38,732 |
| III.—Tharawaddy ... ... | 129,108 | 31,135 | 160,243 | 197,977 |
| IV.—Rangoon ... ... | 43,167 | 6,000 | 49,167 | 42,371 |
| V.—Sitang ... .. | 76,176 | 26,075 | 102,251 | 162,518 |
| Total ... | 277,107 | 72,210 | 349,317 | 506,543 |
| Tenasserim Circle. | | | | |
| VI.—West Salween ... ... | 7,753 | 5,674 | 13,427 | 40,506 |
| VII.—East Salween ... ... | 6,570 | 9,160 | 15,730 | 187,917 |
| VIII.—Attaran ... ... | ..... | ... .. | . . | 30,064 |
| Total ... | 14,323 | 14,834 | 29,157 | 258,487 |
| Drift timber ... ... ... | ..... | ..... | ... | 37,081 |
| Grand Total ... | 291,430 | 87,044 | 378,474 | 802,111 |

# APPENDIX A.

*Khyen practice of ploughing.*

THE following passage occurs in an extract given in paragraph 121 (page 40) from a report by the late Mr. A. O. Brown:

"The Burmans, again, are partially adopting the Khyen practice of ploughing their "choungs, and working one choung for two or three years."

Regarding this passage, Colonel Horace Browne, the Commissioner of Pegu, writes as follows:

"The custom of ploughing, I believe, is confined to the comparatively level patches "which may be found near the borders of creeks; from which creeks a supply of water can "be obtained in the wet season, either naturally, or by temporarily damming up the creeks "to cause an overflow."

# APPENDIX B.

*Memorandum on the working of the Fuel Reserves near the Rangoon and Irawaddy Valley (State) Railway by* D. BRANDIS, *Inspector General of Forests,—dated Calcutta, the 26th January* 1881.

THE length of line open of the Rangoon and Irawaddy Valley (State) Railway is 161 miles, and the quantity of locomotive fuel required annually is estimated at from 10,000 to 12,000 tons of wood at present. But as the traffic is developed the consumption will increase, and the quantity may be expected to be doubled. The local railway authorities report that during the first half-year of 1881 it will cost more to burn wood than coal. It is said that large quantities of wood are still left near the line, but that it mostly consists of large-sized trees, which it is too expensive to cut up for fuel It is said that the cost of cutting up the massive trunks of these trees to suitable sizes for fuel is so heavy as to be simply prohibitory. A good deal may, no doubt, be done towards reducing the cost of breaking up large trunks by blasting, but even then the operation will be very costly. At the same time extensive forests have been reserved in the immediate vicinity of the line for the specific purpose of supplying locomotive fuel, and the aggregate area of these reserves, according to the last annual report, is 62,496 acres. This area is more than sufficient to furnish the requisite supply permanently, if a good system of management is adopted. The point to be kept in view is, to furnish the kinds of wood most valuable for locomotive fuel at the lowest possible cost. Originally, the plan was to allow these reserves complete rest for a series of years, so as to let the forest grow thick and become fully stocked before cutting was commenced. It is clear that the necessities of the case will not permit the carrying out of this plan.

2. The two most important items in the outlay are the carriage of the wood and the cost of cutting. Until the reserves are opened out by roads, a portion only of the area can be utilized for the railway, and the plan of working will at first only relate to this portion. As regards the second point, the question must be considered whether the working plan can be so framed as to provide for the cutting of the younger growth—poles, saplings, and young trees—so as to diminish the cost of cutting. The old trees would be left standing until the cost of labour has diminished sufficiently to make it possible to utilize them for fuel.

3. At first sight this plan seems to be opposed to the principles of rational forestry. But this cannot be helped. Forestry in India must, to some extent, adapt itself to the requirements of the moment. In the present stage of forest administration in India, while it does not yet command general confidence on all sides, some concessions and some compromises must in certain cases be made in order to guard against a reaction, the effect of which might be to sweep away forest conservancy altogether. Such concessions and compromises, however, must be made in a judicious manner and with a clear conception of what we are doing and its probable effect upon the forest. In the present case I am inclined to think that it will not be found difficult to satisfy the requirements of the moment without risking the maintenance of a permanent supply in future. The old trees are not wanted at present; they must therefore remain standing, their branches being lopped wherever this can be done without undue expense After the younger trees and the underwood have been cut, the forest must be closed and fires must be carefully excluded. Reproduction by seedlings and coppice shoots will not be very vigorous under the shade of the old trees, but some growth there will be, if fires are kept out; and it is not impossible that certain kinds which support

shade, while young, will come up readily and will form a thick undergrowth under the large trees. Continued protection from fire, together with the shade afforded by the large trees, will probably have the effect of making the forest more moist and of approximating its character more to that of the evergreen forest.

4. The treatment here recommended will, to some extent, resemble the treatment of that description of forest which in Europe is known as coppice under standards (*Taillis sous futaie; Mittelwald*). The disadvantages of this description of forest management are well known, and yet it is maintained on large areas, particularly of private forest, in France, England and Germany. In Burma the great power of the sun will probably be found to counterbalance to some extent the injurious effect of the shade of the larger trees. Very likely it may become necessary to diminish the shade by girdling a portion of the larger trees if they cannot be utilized, and great care must be used in the selection of those kinds which should be retained for seed. The steam-generating power of the wood of different species is by no means alike. Pyinkado, for instance, has a very high value as a steam-generating fuel, and the reproduction of such woods should by all means be encouraged.

5. The officer deputed to study this subject should make himself acquainted with the experience hitherto gained regarding these matters. As long as the railway continues to burn wood it will be well to make regular experiments in a methodical manner regarding the steam-generating power and fitness otherwise of the different kinds, and the results of these experiments and of the every-day experience bearing upon this subject should be carefully collected by the forest officers. The results will furnish a guide in the management of these reserves. Preference should be given to those species which reproduce most easily and the wood of which is most valuable.

6. But though the production of locomotive fuel was the main object in view in forming these reserves, they are capable of furnishing at the same time timber and other more valuable products which should by no means be neglected. The character of the forest is not the same on the different sections of the line. While south of Oakkan high moist mixed forest prevails, with a large number of Pyinkado and a proportion of evergreen trees, the reserves on the low ground between Thoonzai and Poungday contain a considerable quantity of cutch (*Acacia Catechu*), and some of the fuel reserves, north of Poungday, consist, to a large extent, of Eng forest. These different descriptions of forest will demand different treatment, and as a matter of course, wherever trees can be utilized at more remunerative rates for timber or cutch manufacture than for locomotive fuel, the management of the forest should be arranged accordingly, and the growth of the more valuable kinds should in every case be encouraged.

7. The task of managing these areas to the best advantage, so as to furnish good and cheap locomotive fuel and as large a revenue as possible from timber, cutch, and other produce, and at the same time to secure a good reproduction of the forest, is one of great importance, which will tax the highest skill of the Forester.

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## APPENDIX C.

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*Outturn of Teak timber from the Government Forests in British Burma during the three years* 1876-77 *to* 1878-79.

In paragraph 12 of the orders on the Forest Report of 1879-80 by the Chief Commissioner of British Burma, it is stated that the quantity of teak timber extracted from the Government forests in British Burma during the three years 1876-77 to 1878-79 had been—

| | Tons. |
|---|---|
| 1876-77 ... ... ... .. | 46,431 |
| 1877-78 ... ... ... ... | 39,081 |
| 1878-79 ... ... .. . . | 22,763 |

These figures do not agree with those given in Statement I. appended to this Report as the quantities of timber imported into Rangoon and Moulmein from British territory, which are as follows:

| | Tons. |
|---|---|
| 1876-77 ... ... ... . . | 47,433 |
| 1877-78 ... ... ... ... | 51,381 |
| 1878-79 ... ... ... ... | 35,397 |

In 1876-77 the difference is 1,002 tons, which cannot be fully explained. The data upon which the entry in Statement I. is based are as follows:

*Pegu Circle.*

| | Tons. |
|---|---|
| (1) Brought from the forests by Contractors and Government agency ... ... ... ... | 19,733 |
| (2) Ditto ditto by Permit-holders ... ... | 3,475 |
| (3) Drift timber ... ... ... ... | 3,550 |
| (4) Sleepers ... ... ... ... ... | 1,334 |

*Tenasserim Circle.*

| | |
|---|---|
| (1) Brought from the forests by Contractors and Government agency ... ... ... | 12,253 |
| (2) Ditto ditto by Permit-holders ... | 1,725 |
| (3) Drift timber ... ... ... ... | 3,549 |
| (4) Brought out by lease-holders ... ... ... | 1,814 |
| Total ... | 47,433 |
| In 1877-78 the outturn as entered in the Chief Commissioner's orders is .. ... ... ... | 39,081 |
| To this should be added— | |
| (1) Drift timber, Tenasserim Circle ... ... ... | 2,109 |
| (2) Ditto, Pegu Circle ... ... ... | 9,009 |
| (3) Worked out by purchasers, Pegu Circle ... ... | 1,182 |
| Amount entered in Statement I. ... | 51,381 |
| In 1878-79 the entry in the Chief Commissioner's orders is ... | 22,763 |
| To this should be added— | |
| (1) Drift timber, Tenasserim Circle ... ... ... | 3,409 |
| (2) Ditto, Pegu Circle ... ... ... | 9,225 |
| Amount entered in Statement I. ... | 35,397 |

A portion, however, of the drift timber collected consisted of logs brought from beyond the frontier, and this is fairly represented by the quantity of timber delivered to claimants. The account of drift timber collected and timber delivered to claimants stands as follows:

| *Drift timber collected.* | | *Timber delivered to claimants.* | |
|---|---|---|---|
| 1876-77. | Tons. | 1876-77. | Tons. |
| Tenasserim Circle ... ... | 3,549 | Tenasserim Circle ... ... | 1,833 |
| Pegu Circle ... ... | 3,550 | Pegu Circle ... ... | 2,005 |
| Total ... | 7,099 | Total ... | 3,838 |
| 1877-78. | | 1877-78. | |
| Tenasserim Circle ... ... | 2,109 | Tenasserim Circle ... ... | 1,315 |
| Pegu Circle ... ... | 9,009 | Pegu Circle ... ... | 7,270 |
| Total ... | 11,118 | Total ... | 8,585 |
| 1878-79. | | 1878-79. | |
| Tenasserim Circle ... ... | 3,409 | Tenasserim Circle ... ... | 789 |
| Pegu Circle ... ... | 9,225 | Pegu Circle ... ... | 6,906 |
| Total ... | 12,634 | Total ... | 7,695 |

*Abstract.*

| | | | |
|---|---|---|---|
| 1876-77 ... ... | 7,099 | 1876-77 ... ... | 3,838 |
| 1877-78 ... ... | 11,118 | 1877-78 ... ... | 8,585 |
| 1878-79 ... ... | 12,634 | 1878-79 ... ... | 7,695 |
| Total ... | 30,851 | Total ... | 20,118 |

# APPENDIX D.

## VERNACULAR NAMES.

| | |
|---|---|
| Akyaw ... ... | ... *Aquilaria Agallocha*, Roxb. |
| Anan ... ... | ... *Fagræa fragrans*, Roxb. |
| Bingah ... ... | ... *Nauclea rotundifolia*, Roxb. |
| Chinjook ... ... | ... *Garuga pinnata*, Roxb. |
| Do-Ani ... ... | ... *Eriolæna* sp. |
| Eng ... ... | ... *Dipterocarpus tuberculatus*, Roxb. |
| Engyin ... ... | ... *Pentacme siamensis*, Kurz. |
| Gangaw ... ... | ... *Mesua ferrea*, L. |
| Gwayben ... ... | ... *Spondias Mangifera*, Pers. |
| Hmantin ... ... | ... *Cinnamomum* sp. |
| Kansaw ... ... | ... Unknown. |
| Kanyin ... ... | ... *Dipterocarpus lævis*, Ham: *turbinatus*, Gaertn: *alatus*, Roxb. |
| Karaway ... ... | ... *Cinnamomum* sp. |
| Kokoh ... ... | ... *Albizzia Lebbek*, Benth. |
| Koung-mhoo ... | ... *Parashorea stellata*, Kurz. |
| Kyathoung-wa ... | ... *Bambusa polymorpha*, Munro. |
| Kyello-wa ... ... | ... *Dendrocalamus Brandisii*, Munro. |
| Laizah ... .. | ... *Lagerstræmia tomentosa*, Presl. |
| Letpan ... ... | ... *Bombax malabaricum*, DC. |
| Maizalee ... ... | ... *Cassia sumatrana*, Lam. |
| Maoo-lettan-shay ... | ... *Sarcocephalus cordatus*, Miquel. |
| Mayan ... ... | ... *Bouea oppositifolia*, Meissn. |
| Myin-wa ... ... | ... *Dendrocalamus strictus*, Nees. |
| Myoukshaw... ... | ... *Homalium tomentosum*, Benth. |
| Nee ... ... | ... *Cedrela multijuga*, Kurz. |
| Padouk ... ... | ... *Pterocarpus indicus*, Willd. |
| Pangah ... ... | ... *Terminalia tomentella*, Kurz. |
| Pyinkado ... ... | ... *Xylia dolabriformis*, Benth. |
| Pymma ... ... | ... *Lagerstræmia Reginæ*, Roxb. |
| Shawben ... ... | ... *Sterculia versicolor*, Wall: *villosa*, Roxb: *ornata*, Wall. |
| Tabēndein-wa ... | ... *Bambusa villosula*, Kurz. |
| Thaik-wa ... ... | ... *Bambusa Tulda*, Roxb. |
| Thanday ... ... | ... *Bignonia* sp. |
| Theya ... ... | ... *Shorea obtusa*, Wall. |
| Thingadoe ... ... | ... *Anisoptera glabra*, Kurz. |
| Thingan ... ... | ... *Hopea odorata*, Roxb. |
| Thinkadoe ... ... | ... *Anisoptera glabra*, Kurz. |
| Thitka ... ... | ... *Pentace burmanica*, Kurz. |
| Thitkadoe ... ... | ... *Cedrela* sp. |
| Thitsee ... ... | ... *Melanorhœa usitata*, Wall. |
| Thitto ... .. | ... *Sandoricum indicum*, Cav. |
| Tin-wa ... ... | ... *Cephalostachyum pergracile*, Munro. |
| Toukkyan ... ... | ... *Terminalia tomentosa*, Wight and Arnott. |
| Toungdama ... ... | ... *Cedrela multijuga*, Kurz. |
| Toung Htan... ... | ... *Livistona speciosa*, Kurz. |
| Toung-pein-nay ... | ... *Artocarpus Chaplasha*, Roxb. |
| Toung-thaleh ... | ... *Garcinia* sp. |
| Tounkalamet ... | ... *Cordia fragrantissima*, Kurz. |
| Tounpetwoon ... | ... *Pterospermum acerifolium*, Willd. |
| Tounsaga ... ... | ... *Michelia* sp. |
| Tseikchee ... ... | ... *Briedelia retusa*, Sprengel. |

VERNACULAR NAMES,—concluded.

| | | | |
|---|---|---|---|
| Wa-bgai | ... | ... | *Bambusa villosula*, Kurz. |
| Wa-bo | ... | ... | *Dendrocalamus Brandisii*, Munro. |
| Wa-gouk | ... | ... | Bamboo, species unknown. |
| Wa-klü | ... | ... | *Dendrocalamus Brandisii*, Munro. |
| Wa-möe (Wa-pyoo) | ... | ... | Bamboos, species unknown. |
| Wa-pyoogalay | ... | ... | |
| Wa-ya | ... | ... | *Dendrocalamus longispathus*, Kurz. |
| Yemenoh | ... | ... | *Gmelina arborea*, Roxb. |
| Yoongben | ... | ... | *Anogeissus acumniata*, Wall. |
| Zalooben | ... | ... | *Licuala peltata*, Roxb. |
| Zimbyoon | ... | ... | *Dillenia pentagyna*, Roxb. |

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